JANUARY
1950

# Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

POPPING PERLITE | FROM SOME FORTY PLANTS, MANY NO LARGER THAN THIS, A BIG NEW INDUSTRY IS EMERGING. PAGE 90

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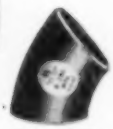
### TUBE-TURN SEAMLESS WELDING FITTINGS — RANGE OF SIZES

| DESCRIPTION | STAND-ARD WEIGHT | EXTRA STRONG | SCHED. 160 | DOUBLE EXTRA STRONG | LIGHT GAUGE NOMINAL PIPE SIZE | LIGHT GAUGE IRON PIPE SIZE |
|---|---|---|---|---|---|---|
| ELBOWS—90° Long Radius | ½"-24" | ½"-24" | 1"-12" | ½"-8" | 8"-24" | ½"-12" |
| ELBOWS—90° Short Radius | 1"-48" | 1½"-48" | | | | |
| ELBOWS—45° Long Radius | ½"-30" | ½"-30" | 1"-12" | ½"-8" | 8"-24" | ½"-12" |
| RETURNS—180° Long Radius | ½"-24" | ½"-24" | 1"-12" | 1"-8" | 8"-24" | ½"-12" |
| RETURNS—180° Short Radius | 1"-48" | 1½"-48" | | | | |
| RETURNS—180° Extra Long Radius | 1"-2½" | 1"-2½" | | | | |
| TEES—Straight | ½"-24" | ½"-24" | ½"-12" | ½"-8" | | |
| TEES—Reducing Outlet | ½"-24" | ½"-24" | ½"-12" | ½"-8" | | |
| REDUCERS—Concentric and Eccentric | ½"x½" 24"x 24" | ½"x½" 24"x 24" | ½"x½" 12"x 12" | ½"x½" 8"x 8" | | |
| CAPS | ½"-24" | ½"-24" | 1"-12" | 1"-8" | | |
| STUB ENDS—Lap Joint | ½"-24" | ½"-24" | | | | |
| SADDLES | 1"-24"** | | | | | |
| LATERALS—Straight | 1"-24" | 1"-24" | | | | |
| LATERALS—Reducing on run | 1"-24" | 1"-24" | | | | |
| CROSSES—Straight and Reducing | ½"-24" | ½"-24" | | | | |
| RINGS—Welding, Given Taper | ½"-24" | 1"-24" | | 1½"-8" | | |
| RINGS—Welding, Ridge Taper | ½"-12" | ½"-12" | | | | |
| SLEEVES—Welding | 1"-24"** | | | | | |

** Since saddles and sleeves are for external configuration only, they do not conform to iron pipe size thicknesses.

90° Short Radius Elbow

90° Long Radius Elbow


45° Long Radius Elbow

Straight Tee

Reducing Outlet Tee

Concentric Reducer

Eccentric Reducer

Lap Joint Stub End

180° Long Radius Return

Cap

Straight Lateral

Saddle

Straight Cross

Welding Neck Flange

### TUBE-TURN FORGED STEEL FLANGES — RANGE OF SIZES

| DESCRIPTION | 150 LB. | 300 LB. | 400 LB. | 600 LB. | 900 LB. | 1500 LB. | 2500 LB. |
|---|---|---|---|---|---|---|---|
| WELDING NECK | ½"-24" | ½"-24" | ½"-24" | ½"-24" | ½"-24" | ½"-24" | ½"-12" |
| SLIP-ON | ½"-24" | ½"-24" | ½"-24" | ½"-24" | ½"-24"* | ½"-24" | ½"-12" |
| LAP JOINT | ½"-24" | ½"-24" | ½"-24" | ½"-24" | ½"-24"* | ½"-24" | ½"-12" |
| THREADED | ½"-24" | ½"-24" | ½"-24" | ½"-24" | ½"-24"* | ½"-12" | ½"-12" |
| BLIND | ½"-24" | ½"-24" | ½"-24" | ½"-24" | ½"-24"* | ½"-24" | ½"-12" |
| SOCKET TYPE | ½"-24" | ½"-8" | ½"-8" | ½"-8" | | | |
| REDUCING—Threaded or Slip-On | ½"-24" | ½"-24" | ½"-24" | ½"-24" | ½"-24"* | ½"-12" | ½"-12" |
| ORIFICE—Threaded | | 1"-24" | 1"-12" | 1"-12" | 1"-12" | 1"-12" | |
| ORIFICE—Slip-On | | 1"-24" | | | | | |
| ORIFICE—Welding Neck | | 1"-24" | 1"-12" | | 1"-12" | 1"-12" | |

† Dimensions on sizes thru 2½" same as for 300 lb. flanges.
* Dimensions on sizes thru 2½" same as for 1500 lb. flanges.

Blind Flange

Welding Ring

Socket Flange

Lapped Flange

Threaded Flange

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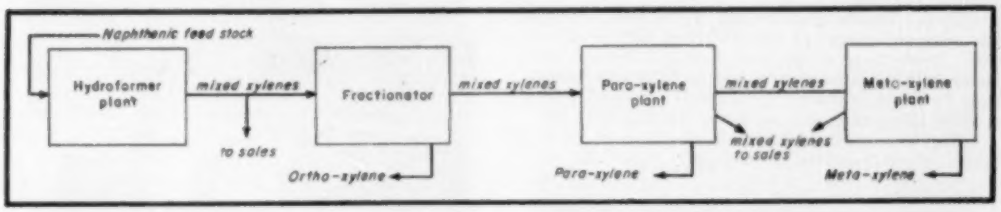



# Oronite Introduces Tonnage Para-Xylene

Oronite Chemical Co. expects to put into operation this spring the first commercial-scale unit in the U. S. to manufacture para-xylene from petroleum raw materials. The product will be of approximately 95 percent purity. The unit, under construction at Richmond, Calif., is the culmination of research and development that California Research Corp., an affiliate of Oronite, began after Standard Oil Co. of California's hydroformer went on stream shortly after the outbreak of World War II. From the hydroformer is derived the mixed xylenes from which the para-xylene will be separated.

Interest in para-xylene is considerable, as a number of chemical companies for some time have been investigating this isomer as a source of a wide range of derivatives. These include resins, dyes, pharmaceuticals, synthetic rubbers, flameproof textiles, solvents and stabilizing agents for olefins and cracked gasolines. The prospect for fiber-forming resins from the isomer is of particular interest.

The process on which design of the new plant is based is one of low-temperature fractional crystallization devised by California Research Corp. Simple fractionation would not suffice, because with the exception of ortho-xylene the components in the xylene mixture have boiling points too close together. Low-temperature crystallization has been used in Germany for separation of para-xylene from coal-tar xylenes. However, the new process represents the hurdling of considerably greater technical difficulties than those encountered in coal-tar work, because of the relatively large amounts of ethyl benzene and paraffinic hydrocarbons in the xylene mixture from petroleum.

Oronite has devoted attention to petroleum-based xylenes for some years, and has been marketing xylene mixtures for the protective coatings industry and other outlets. The company has also been producing ortho-xylene (88 percent purity) on a large scale for the manufacture of phthalic anhydride. For several years meta-xylene, like para-xylene, has been manufactured at Richmond on a pilot plant scale and will continue to be available; this product, of about 95 percent purity, has potentialities in such fields as resins, frothing agents, fumigants and dye synthesis.

Development of new uses for xylene isomers is not limited by the availability of xylenes from coal tar, because supplies adequate for any requirements can be obtained from hydroformer operations. Production of xylenes from hydroforming during the war reached the rate (could have surpassed it) of around 46 million gallons per year, as compared with about 10 million gallons from coal tar.

## Oregon and Paper Makers to Confer

The Oregon State Sanitary Authority has scheduled a meeting on February 15 at Portland with pulp and paper mills. The companies will present their opinions or plans on waste disposal to reduce pollution of the Willamette river.

Companies expected to participate include Crown Zellerbach, Publishers Pulp & Paper Co., Spaulding Pulp & Paper Co. and Oregon Pulp & Paper Co.

The Oregon agency has expressed intention to eliminate waste effluent moving into the river by Dec. 31, 1951, if such effluent does not meet certain tests. That date is the projected time for completion of Portland's $15-million sewage disposal system.

F. N. Youngman, vice president of Crown Zellerbach, says that his and other firms in the region are spending large sums on plant research and grants to colleges in connection with the pollution problem. He says that although Willamette river water, in the raw state, will not be potable, it can be cleaned, and that the pulp and paper industry is paying its way toward solving the problem.

## Paint Maker Drops Farm Chemicals

The Sherwin-Williams Co., paint maker, has liquidated the affairs of its agricultural chemical division; the company is no longer in the business of manufacturing insecticides and weed killers. This development is important to western pesticide manufacturers and consumers, since Sherwin-Williams has been a major producer of these products at its Oakland, Calif., plant for many years.

It is understood that the agricultural chemical division's recent operations have been none too profitable. Also, it has been learned that an Arkansas state supreme court decision late last year (didn't involve Sherwin-Williams) caused the company to view with grave misgivings the legal risks involved in the pesticide business. The court held that unless a manufacturer has placed on the

labels of containers full and explicit warnings about the use and risks of the products, the manufacturer is liable for damages caused by inadvertent application (as by airplane) of chemicals on fields for which they were not intended.

In the West, the company has ceased manufacturing pesticides at Oakland, where 6 to 7 million pounds per year of the products has been made. Production at Oakland and at Bound Brook, N. J. (Sherwin-Williams' largest pesticide plant), has made up the bulk of the company's output in this field.

Up to a month ago it was not certain what would be done with the company's manufacturing plants and business. However, representatives of several chemical companies have been inspecting the facilities at Oakland. Dow, Du Pont, Monsanto and General Chemical, as well as a few others, have been mentioned unofficially.

The company's field research laboratory at Yakima, Wash., ceased operations last summer.

## West Coast's First Tubeless Tires

At Los Angeles, B. F. Goodrich Co. has gone into production of the first tubeless tires to be manufactured on the West Coast. Inventories are being built, with plans to market the product in Los Angeles, San Francisco and Seattle this spring. Tire treads are of the "cold" variety of synthetic rubber. Butyl rubber is also part of the construction.

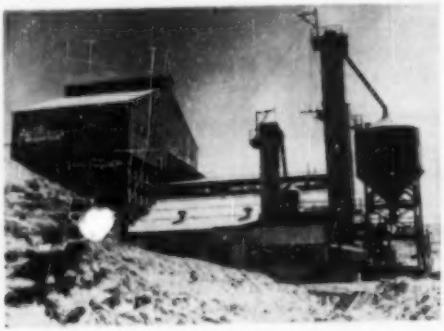
## Loven Chemical Making Phenolics

Loven Chemical of California, organized in 1947, has completed at Newhall, Calif., a plant to manufacture phenolic molding compounds at a capacity rate of about 400,000 lb. per month. Production was scheduled to begin late last month. Other products besides phenolics probably will be manufactured later, according to current plans. Resins and fillers for the phenolics will be purchased.

The manufacturing methods at Newhall are reported to involve simplified procedures and to require a minimum of equipment. The processes are based on a background of experience beginning in 1937. At that time Karl A. Loven, president of the firm, established a research laboratory and pilot plant at Minneapolis for development of phenolic plastics derived basically from inferior coals. With Dr. Loven in the enterprise was H. C. Millerburg, now vice president of the company.

Originally from Germany, and initially engaged in the early coke oven developments in that country, Loven has been associated with the design and construction of coal processing plants in and outside the United States.

On the board of directors is Donald M. Nelson, former WPB head and now chairman of the board of Electronized Chemicals Corp. of New York. Nelson lives in Beverly Hills, Calif.



American Gilsonite's conversion plant

## Gilsonite as Petroleum's Partner

Processing of gilsonite, a petroliferous mineral found in large quantities in Utah, is under way at Salt Lake City in the petroleum refinery of Salt Lake Refining Co., a subsidiary of Standard Oil Co. of California. The plant is handling gilsonite introduced at Bonanza, Utah, into a petroleum pipeline carrying crude from Rangely, Colo., to the refinery.

The operation is furnishing on a large scale, data on the cost and value of gilsonite as an adjunct to petroleum, along lines somewhat comparable to what the Bureau of Mines is doing with shale oil at Rifle, Colo.

At Bonanza, American Gilsonite (jointly owned by Standard and the Barber Asphalt Co.) is mining the gilsonite. Estimates of reserves of the mineral in Utah range from 16 to 25 million tons; a ton is equivalent to about 5 bbl. For many years the product has found uses in protective coatings, insulation compounds and resins.

Methods of processing the gilsonite at Bonanza are considered more or less tentative. There is also a possibility that a coking plant may be constructed to convert the material into coke and liquid oils. Small-scale studies indicate that the coking of 10 tons of gilsonite should yield 5 tons of coke of high grade and 25 bbl. of liquid products.

At present, American Gilsonite is taking the mineral from an open cut, crushing it and feeding it into a "slurry tank." There the product is mixed by turbulence with an inrushing stream of crude oil discharged from a pipe connected with the main Salt Lake City-Rangely pipe line. After being heated to bring about solution, the oil-gilsonite

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mixture is pumped back to the pipe line to join the main body of crude going to Salt Lake City. In that body the gilsonite content is around five percent by weight. At the refinery the product is processed as part of the crude intake.

Tank house almost ready

### Copper Coming

Progress reports issued by officials of Kennecott Copper Corp.'s Utah Division indicate the new $16,000,000 electrolytic refinery at Garfield, Utah, will be completed for early summer of 1950 operations. Initially, the plant will use 12,000 tons of blister a month out of the 17,500 tons of copper smelted monthly at Garfield by the American Smelting & Refining Co., which is currently building a $3,500,000 anode plant scheduled for completion just prior to finish of Kennecott's refinery.

The tank house at the new Kennecott electrolytic refinery contains 1,346 electrolytic cells, each of which required 7 tons of concrete and 1,200 lb. of lead for lining. Anode shapes from the smelter will be placed in these tanks, alternating with cathodes, which are thin sheets of almost pure copper. A hot solution of copper sulphate and sulphuric acid will circulate around the anodes and cathodes, carrying an electric current of extremely high amperage and low voltage.

Electrolytic equipment being installed includes motor generators and transformers to produce the required 125 voltage and 16,000 amperage. The final product of the refinery will be in the form of wire bars, 4 in. square, 5 ft. long, with tapered ends. They will be 99.95 percent pure copper, and will be loaded direct into rail cars for shipment at Garfield or stockpiled.

### American Lignite Has Fire

American Lignite Products Co. suffered a loss unofficially estimated at $100,000 when its extraction plant at Ione, Calif., had a serious fire late last year. The plant, a subsidiary of the DeAngelis Coal Co., Carbondale, Pa., has been manufacturing montan wax and other products from lignite coal. Destroyed in the fire was 150,000 gal. of solvents used in the extraction of wax.

### Tacoma Sulphuric Acid Closer

Tacoma's "smelter," long an imposing figure with its towering stack jutting up from the slopes of Ruston toward the Sound, is letting out its belt right on schedule.

Three new units—announced in 1948 (see *PPI*, Sept. 1948, p. 78)—are under construction at American Smelting & Refining Co.: A sulphuric acid recovery plant, new ore handling facilities and modernization of the arsenic plant. Completion date of the entire multi-million dollar expansion is anticipated for February 1950, upon completion of the sulphuric acid unit.

Using waste sulphur dioxide—always a problem when it escapes up the stack—AS&R will be able to produce up to 100 tons $H_2SO_4$ daily. This output of acid should make Tacoma an even more attractive industrial choice. Several large tanks have been erected and steel for the plant building is going into place.

The new crushing, storage and sampling equipment will handle 200 tons of ore an hour and will replace facilities installed before AS&R took over the smelter operation in 1905.

At the arsenic plant, it's modernization. Arsenic recovered by the Cottrell precipitators will be processed to a finer, purer grade with the new equipment. Working conditions will also be improved.

Construction will begin soon

### Shell Development at Emeryville

Shell Development Co., is demonstrating its belief in the importance of western industrial research by readying plans for a new four-story administration building, in addition to its existing research laboratories at Emeryville, Calif.

The new structure will allow for a shifting and reallocation of space within the Emeryville plant and provide additional space for both laboratory facilities and the large company staff.

Shell Development Co. started at Emeryville in 1928 with a single laboratory building and a staff of 35. With the completion of this new building, their research facilities will cover an area of 15 acres, housing 1,200 employees. Early efforts were directed toward the development of chemicals from petroleum gases. Since 1933 the company's work has been expanded to include the entire field of oil refinery processes and the improvement of products. In 1948, Shell completed the world's first commercial plant for the synthesis of glycerine, an out-growth of work at Emeryville in the field of allyl compounds.

### Marketers Name New Officers

Western Chemical Market Research Group named at San Francisco last month its officers for 1950. They are: George Stern, Heyden Chemical Co., chairman; E. W. Eipper, Oronite Chemical Co., vice chairman; F. G. Sawyer, American Chemical Society, secretary-treasurer. Plans are being developed to carry on this year a cooperative project bearing on chemical markets in the northern California region.

### Another Superphosphate Plant?

Western Fertilizer Association, composed of eight Pacific Northwest cooperatives, is considering the feasibility of constructing a superphosphate plant of about 100,000 tons annual capacity. The organization has obtained rights on a tract of 1,500 acres of the Dry Ridge phosphate deposits near Soda Springs, Idaho.

Where and when the plant will be built depends to

an important degree on the availability of low-cost electric power. Bonneville Power Administration has been asked to make the necessary power available for a plant site in the southern Idaho area. Association officials say the plant may be built in the Columbia River region if the request cannot be met.

## Kaiser Strengthens Aluminum Empire

"Aluminum markets will continue to grow," says Henry J. Kaiser. This explains why Permanente Metals Corp. has bought from War Assets for $36 million the aluminum reduction plant and the rolling mill, both near Spokane, which the company has operated under lease since 1946. The alumina plant at Baton Rouge, La., is also part of the deal that consolidates Permanente's stake in the aluminum field.

The company is counting on two major conditions, aside from civilian demands for the metal, that promise to support the market for some time to come. One of these is the government's requirements for its air force and other military establishments. The other is based on the European Recovery Program.

Kaiser calls attention to a significant sales record preceding the purchase. The company, in the 12-month period ending May 31 last year, sold 249 million lb. of the metal. During the same period the company's net sales of aluminum, chemicals and refractories—$61.6 million—were about 35 percent over sales for the preceding period. The increase in net profits was almost 75 percent.

D. A. Rhoades, vice president and general manager of Permanente, sees the purchases as opening the way to greater flexibility in operations and future developments and, of course, as an announcement that the company is in the aluminum business to stay.

Here are the major groups in the company's completely integrated aluminum business, now solidified by outright ownership:

1. The Baton Rouge aluminua plant, with an annual capacity of a billion pounds of alumina, which goes to the Mead and Tacoma reduction plants in Washington.

2. The Tacoma reduction plant, bought in 1946 from War Assets. Annual rated capacity, about 45 million pounds of metal.

3. The Mead reduction plant, now acquired from War Assets. Annual rated capacity, 216 million pounds of metal.

4. The Trentwood rolling mill, near Spokane, now acquired from War Assets. This highly mechanized, low-cost mill operates on metal from the two reduction plants and has a rated annual output of 288 million pounds.

5. The Owens Lake, Calif., soda ash plant built by the company in 1947 with a daily capacity of 100 tons. The product supplies the Baton Rouge alumina plant.

6. The government plant at Newark, Ohio, which Permanente bought this year to manufacture aluminum cable, wire, rod and bars.

7. The aluminum foil plant, a former German installation that the company bought in 1947 and moved to Permanente, Calif. Capacity is about 750,000 lb. of foil per month.

## What's in a Creosote Plant?

How much of an economic future the lowly creosote plant may have is something New Mexico chemists aim to find out.

C. W. Botkin and P. C. Duisberg, New Mexico A. & M. Agricultural Station chemists, who have been making exhaustive tests on the plant, say one use already has been found for it. It contains an acid which delays rancidity in animal fats and their baked products.

Nordihydroguaiaretic is the scientific term for the acid—chemists have nicknamed it NDGA. The study of this acid started during World War II when there was an urgent need for such an antioxidant because of large animal fat shipment overseas.

In the course of this study, scientists uncovered indications that the creosote bush may contain other more valuable components. It is around these components that State College chemists plan to center their future work.

## Everybody's Popping It

As one of the newer construction materials, perlite is on its way. Nu-lite Co. of Fontana, Calif., is by no means a youngster in the business—C. U. Rechsteiner, president of the company, is one of the early operators in the field. According to official documents, perlite is only four years old as a commercial product. Rechsteiner can point to structures he built nearly a decade back using perlite.

Nu-lite's factory uses volcanic glass mined from company-owned mines in the Castle mountain area on the Colorado desert, shipped to Fontana via Union Pacific Railroad. Here the perlite is "popped" at 2,300 deg. F., and marketed under the trade name Nu-lite.

A few years ago slab concrete became popular for home construction. Rechsteiner made some slabs with perlite. The result was an insulated home with excellent acoustical properties. It was absolutely fireproof, the nearest to earthquakeproof possible, lightning proof and did not require paint. Nu-lite Insulated Homes, Inc., is now one of the company's enterprises. This same type construction has been used successfully in large commercial buildings. Perlite was used in stucco, plaster and walls for the new Mirror newspaper building at Los Angeles.

C. U. Rechsteiner, a pioneer among the small group who experimented with exfoliated perlite for years, began producing the mineral in a small way in 1940. In 1946 the Fontana plant started operations and has expanded repeatedly. Rechsteiner's son, Harry, is plant superintendent.

## Of Firebrick and Dinnerware

Establishment of all Gladding, McBean & Co. refractory research at their Pittsburg, Calif., operations went into effect recently. This move is a big step in the direction of locating basic research centers at the major manufacturing operations of each product. Originally, all basic research for all products—from fire brick to dinnerware—was conducted at Los Angeles. The Pittsburg operation has also absorbed the manufacture of all stiff mud refractories previously carried on at the Livermore, Calif., plant which recently closed.

The company has expansion plans under way in keeping with the ever increasing Pacific Coast market. They have long been a leader in West Coast manufacture of ceramic products which include the well-known Franciscan earthenware, Franciscan china, Hermosa tile, ceramic veneer, clay and silica refractories, sewer pipe and conduit.

Heading the new research facilities at Pittsburg will be Louis Lohman, ceramic engineer. W. M. Estey will continue as superintendent of the Pittsburg operations.

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### New Shale Company for Northwest

A $200,000 plant for the manufacture of light-weight aggregate from expanded shale will be built in Portland by Smithwick Concrete Products Co. The plant is made possible by recent discovery of shale deposits in nearby Washington county. Construction will take place on a 1½-acre tract alongside the company's present plant.

Because of its cellular nature, the weight of aggregate is but one-half that of sand and gravel, making it highly desirable for industrial building and bridge decking.

After the shale is quarried, it is crushed, fed into a rotary kiln and burned at high temperatures. The burning expands the shale to twice its normal size, transforming it into dry cellular clinkers. These are then crushed again and graded to any size desired.

Smithwick's new plant and present operations at Portland and Eugene will be merged into one corporation, with headquarters at Portland.

### Official Education

Washington and Oregon health and pollution control officials have accepted invitations from the Atomic Energy Commission to study effects of the Hanford Works, in eastern Washington, on waters of the Columbia River.

Washington will be represented by E. F. Eldridge, director of the pollution control commission, and Emil C. Jensen, chief of the division of public health engineering in the state health department; Oregon, by Robert R. Harris, senior sanitary engineer, division of water pollution control, and Curtiss M. Everts, Jr., director of the state sanitary authority for the state health board.

The AEC proposes to help educate state officials in the field of health and sanitation aspects of radioactive material and to familiarize them with the safeguards and techniques employed at Hanford Works in controlling environmental contamination by radioactive substances.

### Next Month: Your New Directory

First of its kind for the 11 Western States. First of its kind for any region, as far as we know. Our Directory of Western Chemical & Chemical Process Industries is scheduled for appearance on these pages next month. It will be not merely a list of companies, but a complete directory of each and every producing plant—its company name, its location and the basic type of products made at each plant. We estimate that there will be 1,500 different plants listed. Some plants will be listed several times. Why? Because many produce different basic types of products such as a pulp plant that also makes alcohol and an insecticide filler,

## Another Look at Weyerhaeuser's New Integrated Mill at Springfield, Oregon

Last month (p. 117) we told you about the new Weyerhaeuser mill. Here are some more pictures of what it looks like.

POWERHOUSE, concrete chip storage silos, water treatment system (8 million gallons a day) and sawmill (background).

DRUM BARKER and chippers which start processing that converts 4-ft. logs into Weyerhaeuser containerboard.

CONVEYORS route eight kinds of raw wood to chippers and carry other wood and byproducts to powerhouse for fuel.

MACHINE ROOM where wet kraft pulp is processed into containerboard which is wound on rolls in continuous sheets.

or a citrus plant that turns out chemicals and a fertilizer material.

Only actual producing plants will be listed. Some of the divisions according to types of products: industrial chemicals, pulp and paper, petroleum and natural gas products, fertilizers, soap and soap products, paints and varnishes, sugar, rubber, ceramics, plastics, etc.

Compiled from all available sources of information, our listing is primarily the result of first-hand contacts of our Pacific Coast editors. They have had it under actual compilation for more than a year. It is going to be a supplement to PPI Directory of Western Chemical Producers which appeared in October 1948. It thus completes the picture of the chemical process industries in the West.

## *NAMES IN THE WEST*

M. Souders, Jr.

**Mott Souders, Jr.,** head of chemical engineering research for Shell Development Co., Emeryville, Calif., has been awarded the top award of the American Institute of Chemical Engineers – the 1949 Professional Progress Award in Chemical Engineering. Presentation was made at the Institute's annual meeting in Pittsburgh, Pa., December 7. The award, which carries a prize of $1,000, was presented Dr. Souders in recognition of his petroleum research work. He now holds 20 patents for oil separation processes; has devised an important means of recovering and purifying penicillin; and his toluene process was used to compound about half the TNT used in the war.

**Ernest G. Swigert,** president of Hyster Co., has recently been named a director of Harbor Plywood Corp., Hoquiam, Wash.

**Lawrence H. Cornelius** has been appointed purchasing agent for the American Potash & Chemical Corp., it was announced at Los Angeles by Robert B. Coont, vice president. He succeeds the late **Arvin F. Whitener.**

**Leon Foreman,** formerly with the Coast Chemical Co., is now research director of E. S. Miller Laboratories, Inc., Los Angeles, Calif.

**Kenneth J. Frederick,** from the Paraffine Cos. at Emeryville, Calif., has joined the research staff of Abbott Laboratories, North Chicago, Ill. He will organize and head a phyiscal chemistry department.

**Leo R. Gardner** has been appointed vice president and manager of research and development of the California Spray-Chemical Corp., Richmond, Calif. He has been manager of the research and development department, including the chemical control division.

**Lloyd L. Ingraham,** formerly teaching assistant and research fellow at the University of California at Los Angeles, is now chemist in the fruit products division of the Western Regional Research Laboratory, Albany, Calif.

**John J. Bogner** has recently been appointed in charge of the Borden Co., chemical division, California territory, with headquarters at San Mateo, Calif. Bogner will handle technical sales and service to California plastics, plywood, furniture and mineral wool insulation manufacturers. For the past three years he was Pacific Northwest manager for Interlake Chemical Co.

**S. R. DuBravac** has been named permanent manager of the Basic Magnesium plant properties at Henderson, Nev. He will succeed **John Mueller,** member of the Nevada Colorado River Commission. DuBravac has been assistant to Mueller for the last several months. Appointment was made by Governor Vail Pittman of Nevada.

**E. W. Cannon** was named vice president and manager of the marketing department for California Spray-Chemical Corp., Richmond. Cannon, who was formerly western manager of marketing, joined the company in 1929 as a field representative.

**H. W. Finnell, Jr.,** has been named Pacific Coast sales manager for Phelps Dodge Copper Products Corp., with headquarters at Los Angeles.

**Fred G. Galer,** formerly advertising manager for Monsanto Chemical Co.'s Western Division at Seattle, Wash., has been appointed sales manager of the Preservative Paint Co., Seattle. He had been with Monsanto and its predecessor, I. F. Laucks, Inc., since his graduation from the University of Washington 12 years ago.

**J. I. Hamilton,** formerly with the Curtiss Wright Corp., and a graduate of Massachusetts Institute of Technology, has been appointed general sales manager of Menasco Manufacturing Co., Burbank, Calif., replacing **B. C. McNeill** who resigned.

L. A. Gibbons

**L. A. Gibbons** has been named vice president and general counsel for Union Oil Co. of California. Gibbons followed a private law practice in Los Angeles before joining Union Oil as sales department attorney in 1930. He was elected a company vice president in October 1949.

**K. B. Jacobsen** will be the new West Coast secretary of Liquefied Petroleum Gas Assn., at Oakland, Calif., succeeding **Don McNary,** who resigned to join Calor Gas Co., Oakland.

**T. J. Gerber,** formerly head of the Minneapolis sales office of Kaiser Aluminum and Chemical Sales, Inc., has been appointed district manager at Seattle. He succeeds **Jack W. Watson, Jr.,** promoted to the position of Central Division sales manager of Kaiser Aluminum at Cleveland. **O. J. W. Johns,** takes Gerber's former spot.

PROMOTIONS—Good news for Kaiser's Pooler, Lewis & Shaper

**John V. Pooler,** superintendent of Kaiser Gypsum's Long Beach plant, has been promoted to manager of operations of all company plants and quarries. In addition, he will supervise shipping and construction activities of the organization. **John O. Lewis,** formerly superintendent of the Redwood City plant, will assume the duty of supervising production of the company's Long Beach plant; **Ernie Shaper** becomes superintendent of the recently acquired Redwood City plant.

# FIRMS IN THE WEST

**Hugo Klein** has moved his consulting service from Houston, Tex., to 1914 East Orange Grove Ave., Pasadena 7, Calif. His specialties are paper technology, reproduction processes and equipment, rice processing, solvent extraction of rice bran oil, chlorination of hydrocarbons, and organization and administration of research and production in these and other chemical engineering fields.

**E. R. Squibb & Sons** has opened its new southern California and Arizona district headquarters at 2533 Eastland Ave., Los Angeles, at an expenditure of $500,000. Local force is headed by T. I. McGuire, sales manager, Los Angeles division; Karl Emans, branch manager; and B. B. Drake, district manager.

**Raymond S. Hatch,** consultant, has moved from Longview, Wash., to Monterey, Calif., where he is continuing his consulting practice on pulping, bleaching, and pulp purification. Mr. Hatch was formerly with the Weyerhaeuser Timber Co., where he was research director of the pulp division.

**Lawton Research Laboratory** is the name of a new company headed by H. C. Lawton at Fillmore, Calif., to deal with problems relating to rotary drilling fluids, reconditioning of oil wells and analyses. He was formerly with Oilwell Chemical and Materials Co., Inc., as eastern representative.

**The Union Oil Co. of California** was due to open a divisional office in Denver to serve the Rocky Mountain area, about January 1. The divisional manager will be E. R. Atwill, formerly of Pasadena, Calif. Offices will be established in the Paramount Building, Denver.

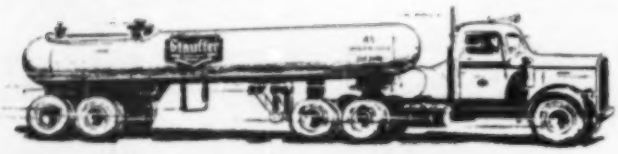
**Paul Bancroft, Jr.,** San Francisco, has been appointed California distributor of Mill Creek insecticides, with offices at 731 Market Street, San Francisco.

**Standard Oil Co. of California** has made a grant-in-aid totaling $250,000 to support Massachusetts Institute of Technology's research program. It is the expression of the desire of Standard to collaborate with the Institute. A substantial part of the grant is to be used in support of chemical engineering and chemistry, nuclear science and engineering, and research in the fields of lubrication, friction and wear and corrosion.

**Coast Paint & Chemical Co.,** Los Angeles, has purchased formulas, processes, engineering blueprints and manuals of Technical Coatings, Inc., of Pasadena. The Pasadena firm's processes and materials have been used to seal fuel tanks on aircraft. Coast Paint & Chemical Co. is establishing an engineering and research laboratory which will specialize in problems of tank design.

**Kaiser Aluminum & Chemical Sales, Inc.,** is engaged in its first activity in the chemicals container business by acting as nationwide marketing agency for Benson Manufacturing Co., Kansas City, Mo., which is manufacturing ICC approved welded aluminum drums in 15 and 55-gal. sizes from sheet furnished by Kaiser's Trentwood rolling mill in Washington state. Built in several types the drums are designed for a variety of chemicals and petroleum products.


Stauffer

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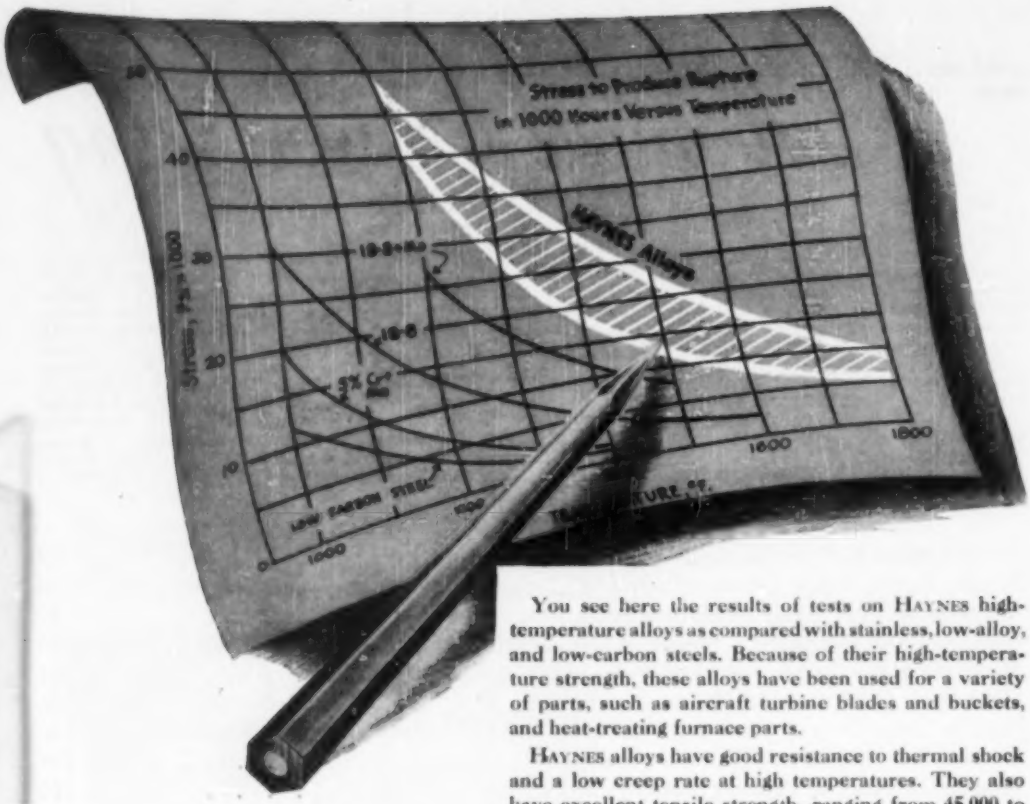


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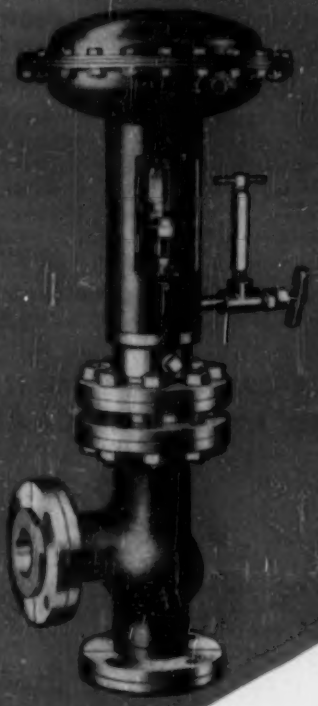

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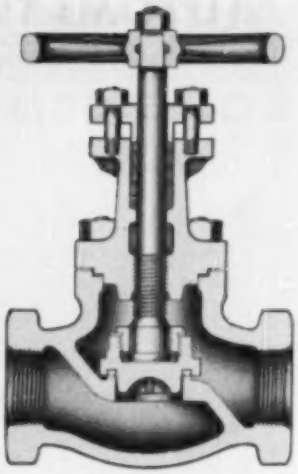

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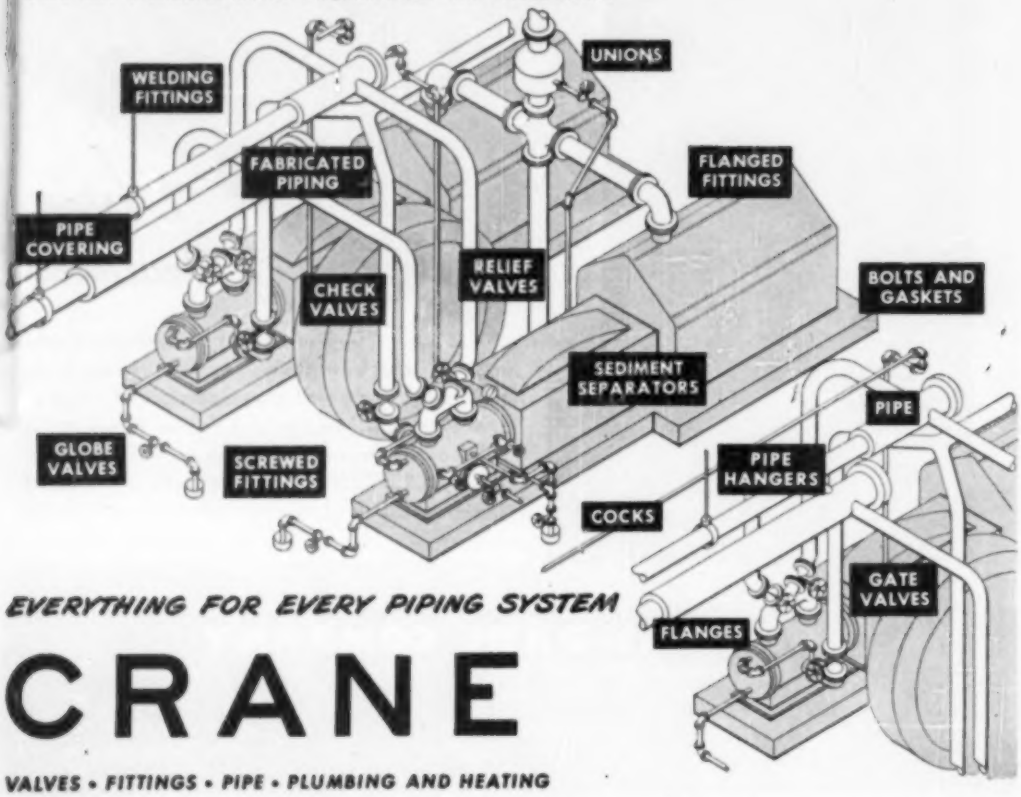


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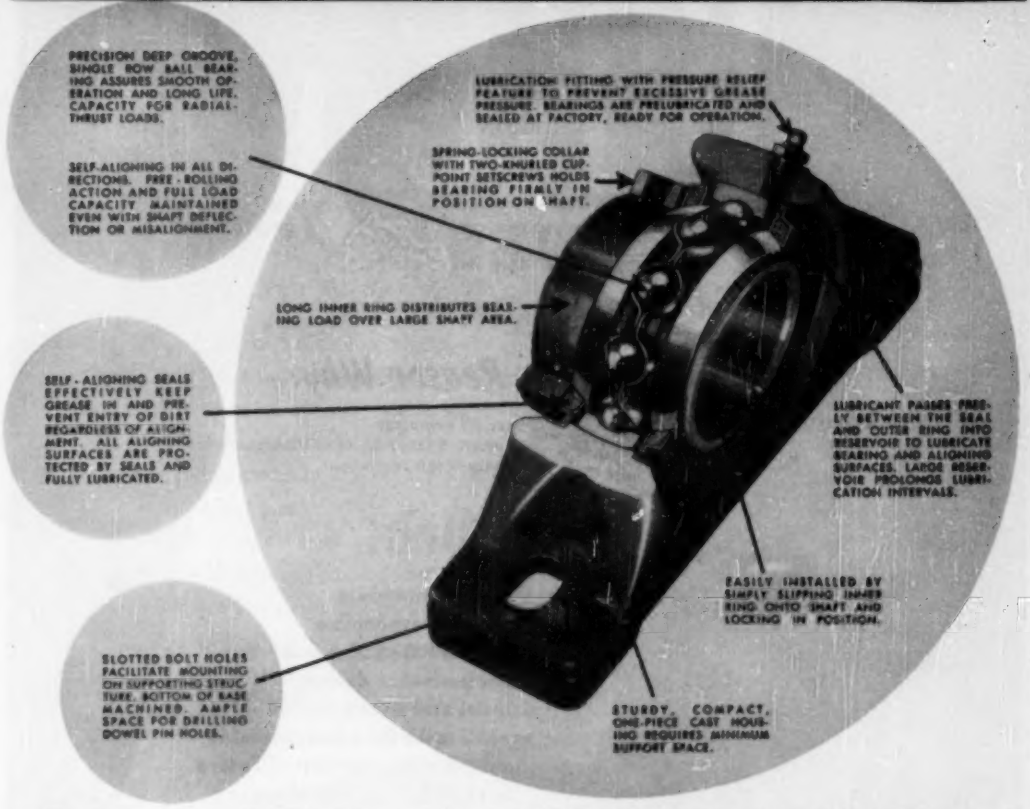
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With Bailey controls, replacement part stocks are held to a minimum because parts are interchangeable. Maintenance costs are less, too, because maintenance men quickly become familiar with the standardized Bailey units.

Bailey bulletin No. 17 shows how you can use this improved control system. Write for your copy and keep it handy for reference the next time you need process controls.

P-19

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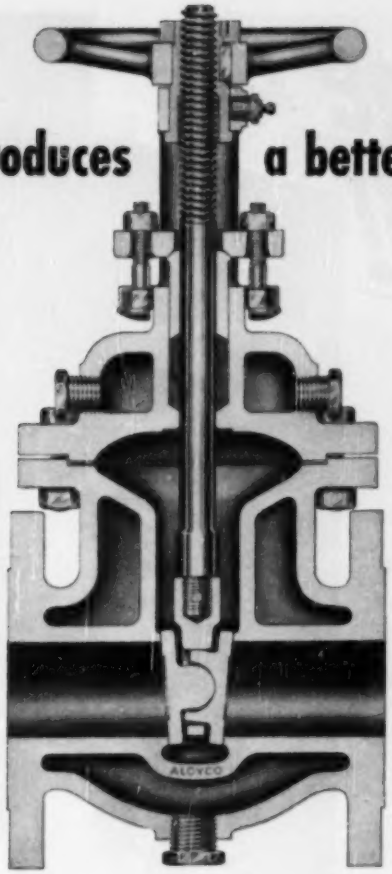
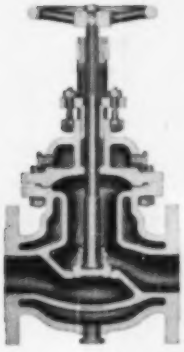
**4 + 8 Works Here** at the Wyandotte Chemicals Corporation North Plant, Wyandotte, Michigan

# ALOYCO introduces a better jacketed valve in stainless steel and corrosion-resistant alloys



• Aloyco Jacketed Valves are made in three basic styles: Gate (No. 1105), Globe (No. 1305) and Check (No. 1505). Jacketed flanged tees and 90° elbows are also available in straight sizes.

HERE are the first *completely* jacketed valves in solid alloy. They are recommended for accelerating the flow of viscous liquids where corrosion is a factor. Their performance is outstanding with phthalic and maleic anhydrides, rosin and resins, tars and tar oils, molten sulfur, and many other fluids difficult to move at room temperature.

The sectional views illustrate the thoroughness of Aloyco jacketing. Note how it extends to the edges of the flanges. Also, observe that the bonnets are fully jacketed, as well as the bodies. In designing these valves, our engineers have retained all the Aloyco standard features, such as double disc wedges which are non-fouling and are pressure-tight on both seats. Aloyco Jacketed Valves are the embodiment of engineering, pattern-making and foundry skills of a high order.

Send for our new Bulletin No. 3.

***Aloyco Valves are manufactured in compliance with the new MSS Stainless Steel Valve Standards S.P.-43.***

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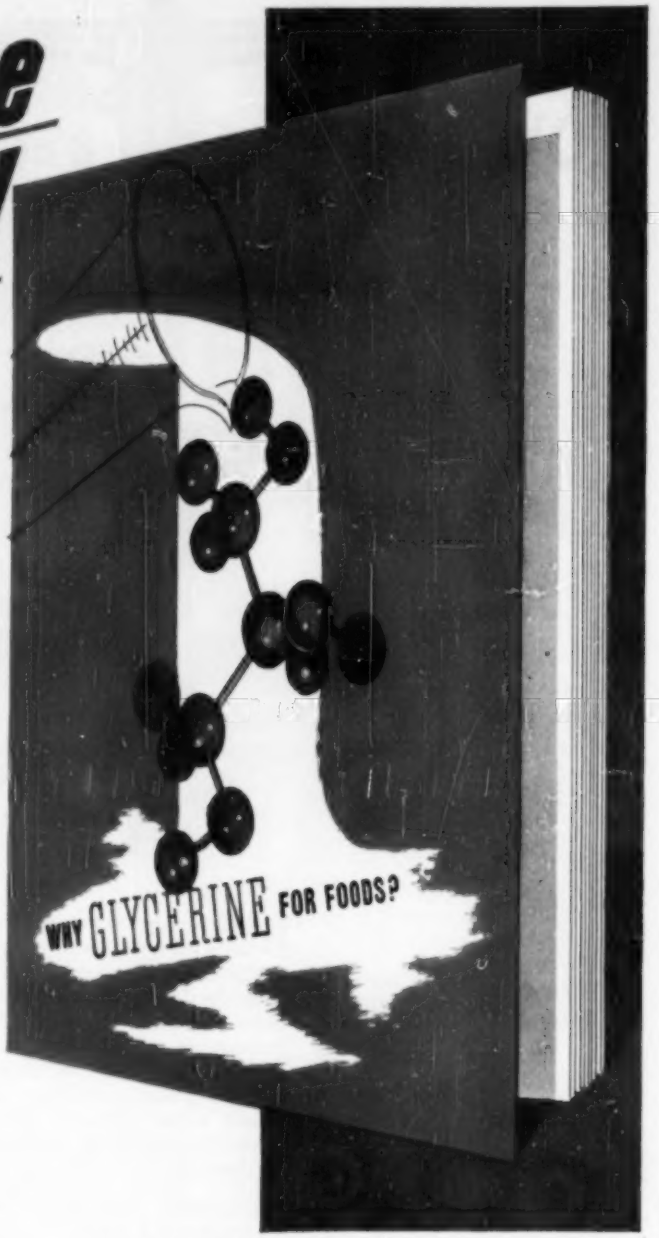
"Why Glycerine for Foods?" has been reviewed by a number of technical consultants as well as the Research Laboratories of the Glycerine Producers' Association. Contains detailed information by charts and tables of the physical properties of glycerine—the origin, development, and chemistry of this amazingly useful alcohol—grades and their applications. 16 pages of practical, useful data!

Whether you now use glycerine or just wonder about its possibilities . . . whether you're in management, production, or research . . . an expert on glycerine, or thoroughly unfamiliar with the subject—you'll want this informative booklet. Write for your free copy—today! *Address: Dept. 4, Glycerine Producers' Association, 295 Madison Avenue, New York 17, New York.*




*One of a series of five booklets on the industrial applications of glycerine. Also available on request: Why Glycerine? (a general survey of all main uses) . . . Why Glycerine for Alkyd Resins and Ester Gums? . . . Why Glycerine for Drugs and Cosmetics? . . . Why Glycerine for Textiles?*

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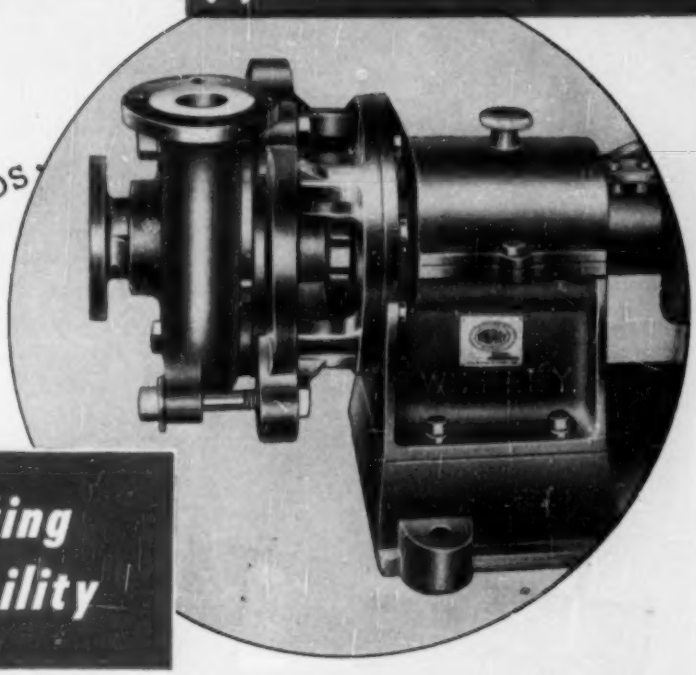

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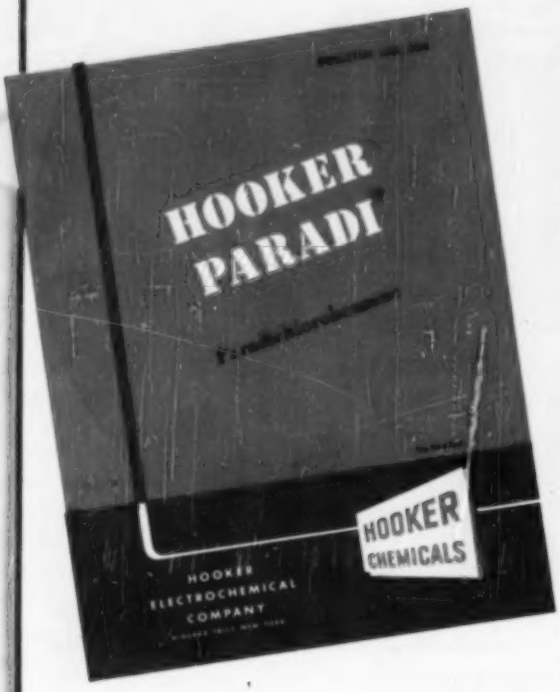
# WILFLEY *Acid* PUMPS

# *Send for this Guide to Increased Profits*

## with Hooker Paradichlorobenzene




HOOKER's new Bulletin No. 454 on Paradichlorobenzene can be your guide to increased sales and profits if you are interested in the fumigant, deodorant and disinfectant markets. It describes the many uses and application of paradichlorobenzene, methods for reforming and repackaging—contains a table and illustrations of exact screen sizes—just the information a repackager or specialty manufacturer needs.

Hooker Paradichlorobenzene is a crystal clear, high purity product that evaporates completely, leaving no residue and no stains. It is not injurious to fabrics, furs or hides and is not poisonous to human beings.

It is made available in seven graduated sizes from powdered to Pea No. 1 (Screen size through 5/8" on 2½).

**TYPICAL PROPERTIES**
**HOOKER PARADICHLOROBENZENE**

| | |
|---|---|
| Appearance | White to clear transparent |
| Form | Crystals in 7 sizes |
| Melting Point | 53°C |
| Boiling Point | 173°C |
| Residue on Sublimation | None |
| Shipping Containers | 25, 50, 100, 200 lb. Fibre Drums |

A request on your company letterhead will bring this bulletin to you promptly. Chemists who are interested in other physical and chemical properties should ask for Technical Data Sheet 749.

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More and more users are turning to the complete line of Tri-Clover Stainless Steel Fittings and Valves as they discover their exclusive advantages of design and operation that result in increased production at lower installation and maintenance cost.

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**Other Tri-Clover products:**
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*Zephyrweld* BUTT WELD FITTINGS
... in Stainless Steel types 304, 347, 316, full range of fitting types in IPS and OD tube size from ¾" thru 24".

*Recessed End* FITTINGS ... in Stainless Steel types 304, 347, 316 — complete range of fitting types, in sizes from ¼" thru 24" — for soldering, brazing or socket welding.

# De Laval Turbines Reduce the Cost of Power

We clipped this article from a recent power journal because it does such an excellent job of emphasizing the savings that can often be effected by installing high pressure boilers and modern turbine generators.

Why not check into your own power and steam costs? Recent installations like the ones shown below have proven that savings can be substantial. For more complete information write for Bulletin 4200M.

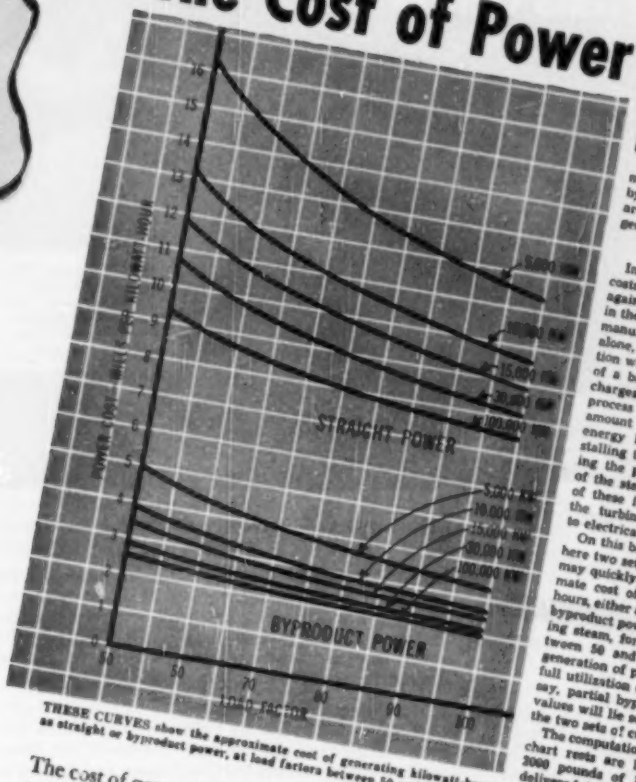
▲ De Laval 8000 KW condensing turbo-generator receiving steam at 550 psig, with extraction at 90 psig.

▲ 3500 KW De Laval turbine generator serving a large Mid-Western metal working plant.

▲ De Laval 3000 KW non-condensing topping turbine installed in a chemical plant.

▼ 5000 KW De Laval turbine generator with automatic extraction.

# The Cost of Power




THESE CURVES show the approximate cost of generating kilowatt-hours, as straight or byproduct power, at load factors between 50 and 100 per cent

The cost of generating electrical energy locally may be high or low. It depends on a number of factors, particularly the extent of the demand for process steam

DAVID MOFFAT MYERS • MYERS, FULLER & ADDINGTON
CONSULTING ENGINEERS, NEW YORK

How much does it cost to make a kilowatt-hour with a steam plant? The answer depends upon where it is to be made, how much electrical energy is to be generated in a year, and at what load factor; what fuels will be available and their cost per million B.t.u.; the quality of the water supply; the kind of labor available and rate of pay. Last, and most important of all, it depends on the amount of steam that may be required for heating or process along with the kilowatt-hours.

If no steam is needed for process or heating purposes, we have a straight power job. On the other hand, with a relatively large requirement for steam as well as power, we may have 100 per cent byproduct power generation.

The straight power will cost the most per kilowatt-hour and the byproduct power the least. These are the two extremes of cost in the generation of electrical energy.

**Cost of Byproduct Power**

In straight power generation all costs of necessity are chargeable against the energy as produced. But in the case of byproduct power, the manufacturing and heating steam alone, without any power generation whatever, requires installation of a boiler plant of full capacity, chargeable entirely to heating and process steam. For this same amount of steam the byproduct energy becomes available by installing topping turbines and raising the pressure and temperature of the steam. Only the extra cost of these items and attendance of the turbine room are chargeable to electrical energy.

On this basis there are presented here two sets of curves from which may quickly be found the approximate cost of generating kilowatt-hours, either as straight power or as byproduct power from manufacturing steam, for any load factor between 50 and 100 per cent. For generation of power with less than full utilization of steam—that is to say, partial byproduct power—the values will lie somewhere between the two sets of curves.

The computations upon which the chart rests are based on $10 for 2000 pounds of 13,000 B.t.u. coal delivered in the overhead bunker. Prevailing prices and costs have been used for labor and the purchase and installation of power plant equipment, including land, buildings, and all auxiliaries.

While any individual case will be governed by the design of the plant and the specific conditions and factors involved, the chart serves as a fair indication of the spread between the cost of straight power and byproduct power generation.

The upper curves apply equally well to central stations of public utilities of the capacities indicated, the cost per kilowatt-hour being taken at the outgoing bus. Before the consumer gets the juice there must be added, of course, the necessary charges to cover transmission, distribution, and service.

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With the new test head for the metals comparator, you can quickly and easily measure the depth of wearing surfaces, such as machine-tool beds.

**cuts production costs . . . helps maintain high quality of product**

When one day during World War II a truck driver delivered at the Ft. Wayne Works 25,000 motor shafts, mistakenly intermixed, he started G-E engineers on the development of an important new instrument for industry.

To separate the shafts, Ft. Wayne engineers rigged up an oscillator, multi-winding transformer, amplifier, and an oscilloscope, and then identified each shaft by comparing its wave pattern with the known wave patterns of the different kinds of steel used. Realizing the importance to industry of such equipment, G-E engineers developed a compact comparator for both ferrous and nonferrous metals.

**Cutting Costs** This instrument helps you cut costs by enabling you to separate or to identify metals quickly. For example, stock-room clerks use the instrument to separate machinable parts of cold-rolled steel from nonmachinable parts made from stainless steel. This reduces cutting-tool losses.

**Maintaining Quality Control** To help maintain the high quality of your product, use the comparator to measure the depth of case hardening, to determine changes in plating thickness, and to assure the use of specified metals.

**A G-E Instrument for Your Problem** G-E engineers may be able to help you solve your measuring or testing problems by recommending one of the many available G-E instruments. Your problem, if it is common to industry, may even justify developing a new instrument. Write today for information. Apparatus Department, General Electric Company, Schenectady, N. Y.

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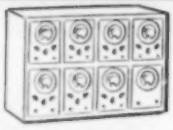
Coil Testing

Time, Speed and Torque



Force, Strain and Thickness Gages

## To Cut Costs in Your Developmental Work

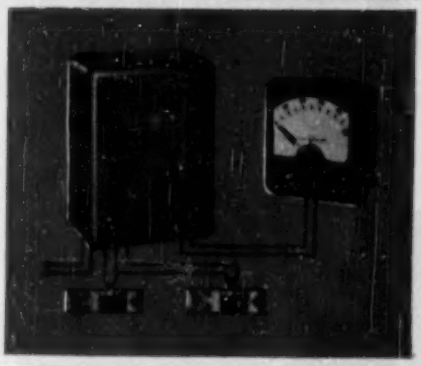
### . . . use G-E fatigue tester to study fatigue limit and failure of metals and plastics

Equipment designers and metallurgists can save time—and money—by using the G-E fatigue tester to determine the fatigue limit of different alloys or plastics.

By fatiguing materials at resonant frequency, the G-E instrument reduces the amount of time required for each test. Because the instrument, which uses air pressure to vibrate the material specimen or finished part, has no moving parts, maintenance expense is negligible. Furthermore, you can test both standard specimens and odd-shaped parts, such as turbine buckets. Write for GEA-4652.

## To Increase Life of Your Equipment

### . . . check for excessive strain with G-E magnetic strain gage

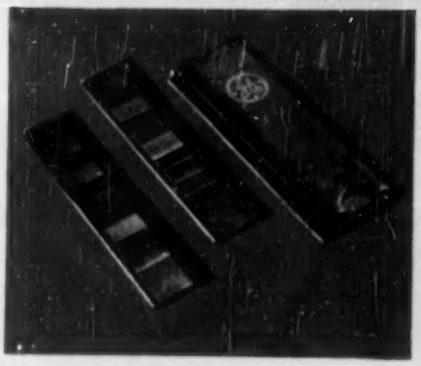


You can safeguard the life of construction, industrial, and transportation equipment by using the G-E magnetic strain gage to test shovel and crane structures, punch presses, dies, test-stands, tanks, railroad tracks, locomotive trucks, bridges, and truck frames. Easily attached or removed from the equipment under test, the strain gage is protected against normal vibration or shock. No amplifier is required.

This gage equipment measures either slowly varying or rapidly varying strains. A pointer on an easy-to-read scale indicates the amount of stress. Write for GEA-3673.

## To Cut Costs in Specifying and Inspecting Finishes

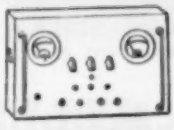
### . . . use the New G-E roughness scales



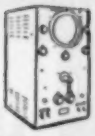
The 24 sample surfaces of the scales are divided into ten groups representing ten degrees of surface roughness. Some groups have several machining operations represented. Use of the scales cuts production costs three ways—

Engineers and designers save time because they need only to refer to the scales to specify finishes. Inspectors can handle additional work because they can use sight and touch to compare quickly the finish on a machined part with specified finishes. Machinists turn out extra work because they can avoid making unnecessarily fine finishes; reduce spoilage because they can avoid making too-rough finishes. Write for GEC-311.

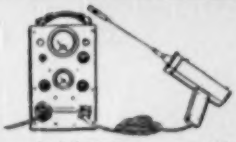
Materials Testing



Chemical Analysis



Insulation Tester



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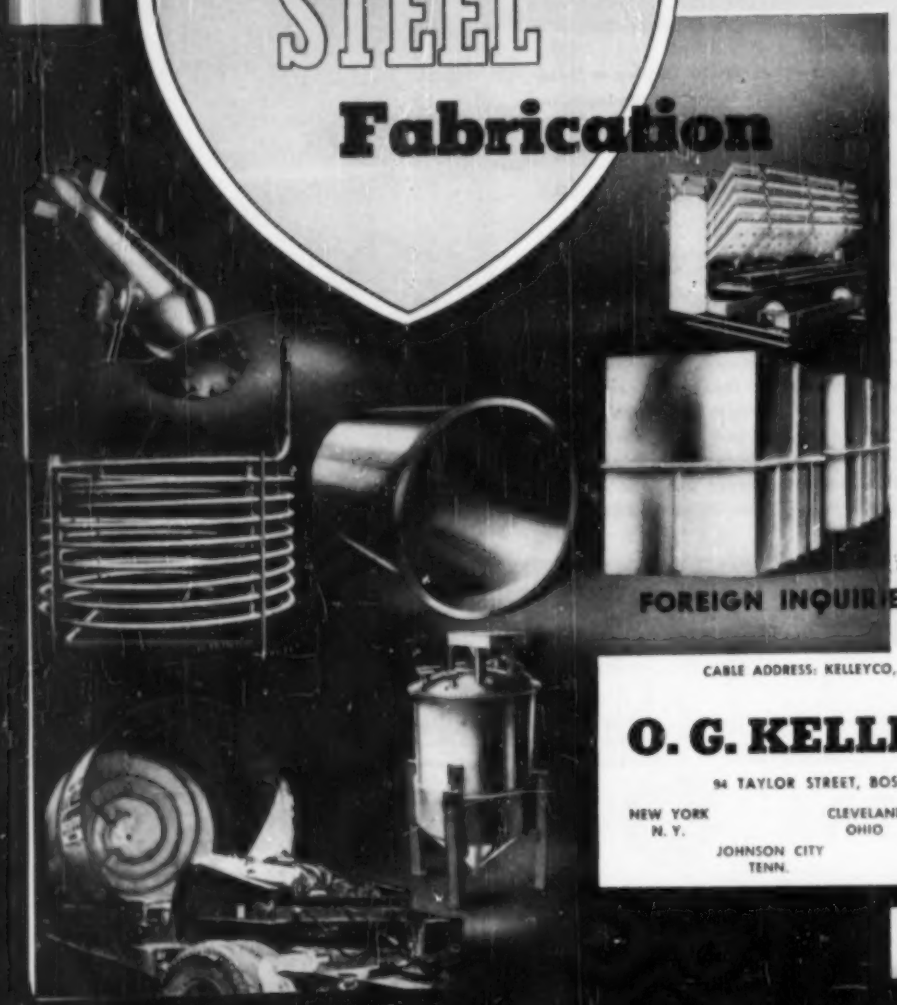

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include if you designed and built it yourself . . . affords positive temperature protection.

Together, they make a pair of mighty valuable tools for heat process control which you can't afford to overlook. Call in your local Honeywell engineer for detailed information . . . or write for Specification Sheets 112 and 113.

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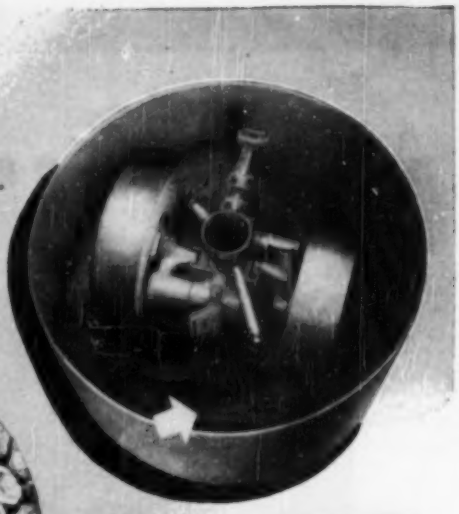

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The two photomicrographs at the left show a simple mixture of sand, clay and water. The problem here called for uniting and coating sand grains with a film of clay (similar to many material blending problems). The lower sample was mixed in a paddle mixer—note the smear of unmixed clay. The upper sample was *mulled* in a Simpson—note the uniform coating and equal distribution of all grains.

Let a National Engineer show you how to solve your mixing problems . . . better, faster, at less cost . . . by *mulling* in a Simpson *Mix-Muller**. Write for full details.

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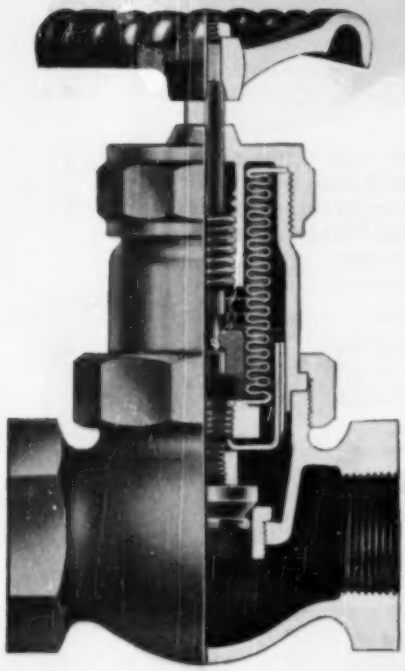
# It stopped costly leaks —paid for itself in just a few weeks!

# SYLPHON PACKLESS VALVE



SYLPHON PACKLESS VALVES pay for themselves many times over, in stopping losses of valuable liquids or gases. In one plant, a valve prevented liquid leakage that more than paid for the valve—in just a few weeks!

And Sylphon Packless Valves have extra advantages where hazards are involved. They guard against explosion, fire and other damage . . . protect you and your equipment.

The feature that "makes" the Valve is a dual-ply, seamless Sylphon metal bellows, which replaces customary packing. It stops even tiniest leaks that might seep past the stuffing box of an ordinary packed type valve.

Providing a positive seal, the bellows is metal-housed for protection against erosion. It seals the valve stem against corrosive, dangerous or inflammable liquids or gases.

Installed on pipe lines carrying oil, gasoline or other volatile liquids or vapors, Sylphon Packless Valves are widely used in chemical plants, oil refineries, power plants, aboard ships. Available in many sizes and types. Get all the details—write today for free Bulletin AC-813.

*Cutaway view of No. 304-N Sylphon Packless Valve. Sizes from ½" to 2" for pressures up to 150 lbs. Types with flanged connections available. For vacuum service, No. 304-NV is ideal.*

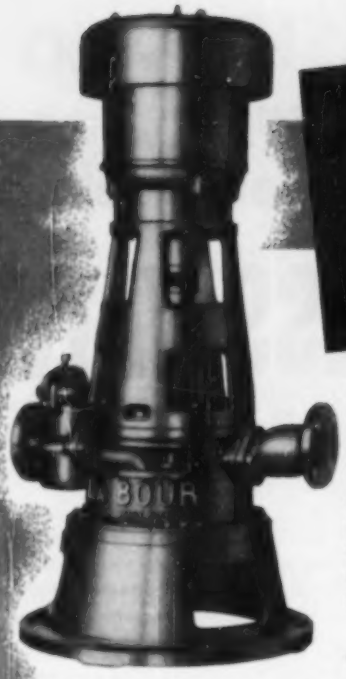
FS

FIRST WITH BELLOWS

*Temperature Controls • Bellows Devices • Bellows Assemblies*

FULTON SYLPHON DIVISION

ROBERTSHAW-FULTON CONTROLS CO., KNOXVILLE 4, TENN.



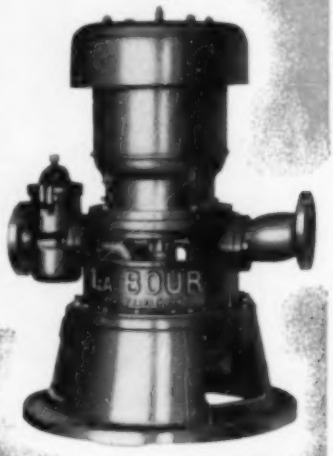
# MAINTENANCE-FREE
## Pumping Service Gets a NEW MEANING

For more than 27 years, LaBour pumps have been noted for dependability of service with minimum maintenance requirements. With the introduction of Type G LaBour pumps, packing difficulties were eliminated because there is no packing, no rubbing seal of any kind—standing or running—in a Type G. It was a revolutionary development in the field of self-priming centrifugal pumps.

Now, the modified Type G, designated as Type BG (and as BGM when motor is direct-mounted), goes still further toward eliminating the necessity for visits by the maintenance man. Lubrication has been improved, there are better safeguards against fumes, construction has been simplified, volatiles and toxics can be handled.

If you haven't seen a LaBour Type BG and considered how it can save you money in moving corrosive or dangerous liquids, it will pay you to investigate without delay.

**THE LaBOUR COMPANY, Inc.**
**Elkhart, Indiana, U. S. A.**



# LaBOUR Type BG

Send for Bulletin 52. Get the full story of LaBour Type BG. If you'll tell us your pumping problem, we can be specific in showing how this pump can solve it.

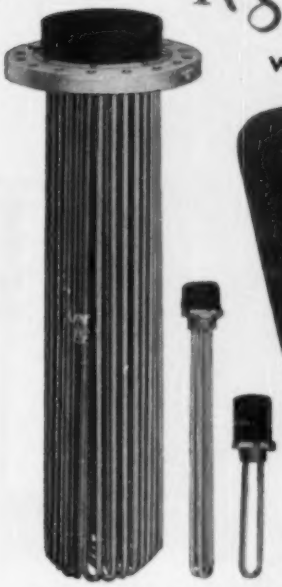
# HEAT GASES AND LIQUIDS

Efficiently and Economically

"*Right on the Job!*"

with

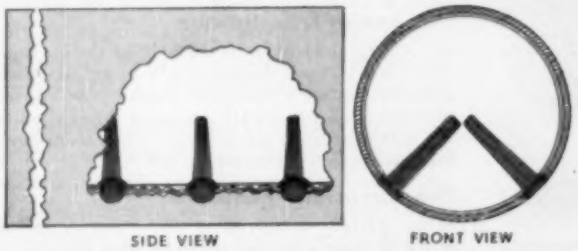
**CHROMALOX**



TMO Type Immersion Heaters are made in sizes up to 75 KW to operate in temperatures up to 800° F. and pressures up to 600 pounds.

CHROMALOX Tubular Immersion Heaters are used for heating compressed air and other gases: for super-heating steam; for heating liquids and Dowtherm, Prestone and similar heat-transfer mediums. They can be readily applied to high-temperature and high-pressure operations.

CHROMALOX Electric Immersion Heaters give you the *exact* temperatures you require and maintain these temperatures accurately. Dependable performance, economical operation, reduced spoilage are among other advantages gained by using these easy-to-install heaters.



SIDE VIEW FRONT VIEW

GIANT STEAM ACCUMULATOR USING CHROMALOX IMMERSION HEATERS (SIMPLIFIED VIEW)

Twenty-four TMO Heaters of 24 KW each are used in this steam accumulator (approximately 72 feet long, 8 feet diameter) to maintain 300° F steam temperature.

This installation was worked out on the job by Chromalox Application Engineers who are always ready to help solve your heating problems.

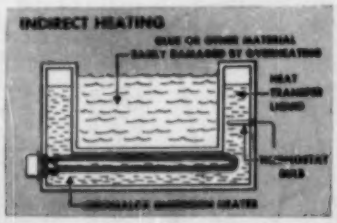
**CHROMALOX**

**Electric Heat for Modern Industry**

**EDWIN L. WIEGAND CO. 7514 Thomas Boulevard · Pittsburgh 8, Pa.**

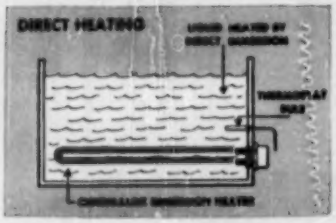
## *Typical Examples*

of a few of the many uses for Chromalox Immersion Heaters



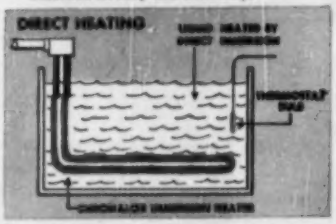

WATER OR OIL JACKETED KETTLES

Heaters are quickly and easily mounted in kettle wall; temperatures are accurately maintained manually or by automatic control. Uniform heat transfer makes this application particularly good for liquids that must be heated slowly to prevent damage by overheating.




HEATER MOUNTED PERMANENTLY IN TANK

Chromalox Immersion Heaters are welded or bolted through tank wall. Heaters are sheathed in copper, steel or alloy—as required to defeat corrosion. Temperatures are controlled thermostatically. Heat is absorbed directly and efficiently.




FOR HEAVY-DUTY IMMERSION HEATING

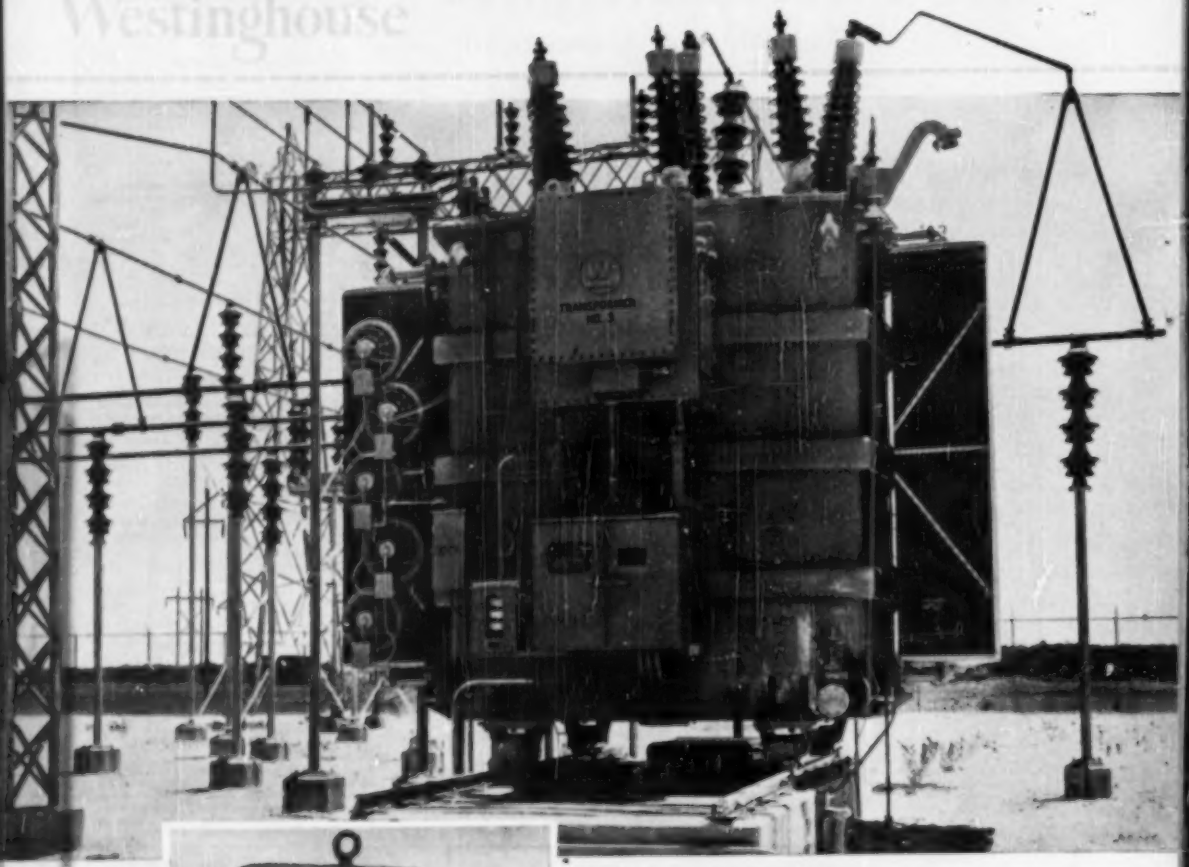
Low-density Immersion Heaters are especially designed for high-temperature melting-pots or salt baths. Heaters have legs to raise elements above sludge accumulation. They are quickly installed and easily removed for maintenance.

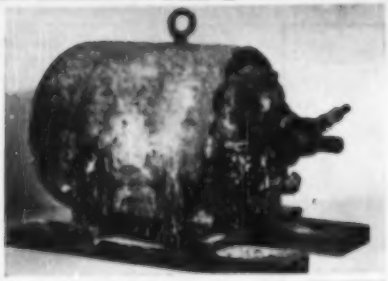
*Want more Examples?*

Request the fully-illustrated booklet "100 Ways to Apply Electric Heat." It contains photographs and drawings showing Chromalox Electric Heaters at work in plants throughout the United States. Write today for your copy.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse





**This power transformer**

in a chemical plant is an example of the corrosion-resistant equipment designed by Westinghouse for the Chemical Industry. To resist weather and corrosive conditions, all transformer tanks are Bonderized. All-welded construction assures positive protection against leaks, moisture or corrosive fumes.

**The corrosion-resistance**

of the specially coated, heavy steel, Life-Line chemical motor is shown by the results of this extended salt spray test. Shown here are a cast-iron chemical motor (above) and the Life-Line chemical motor (below) after operating for several months in a 20% salt spray. At the end of this time, the Life-Line motor continued to operate while the cast-iron motor had failed. An examination of both motors showed considerably less corrosion on the Life-Line motor.

# We help you fight corrosion

THREE WAYS

To help the Chemical Industry combat corrosion, Westinghouse has developed an extensive line of corrosion-resistant electrical equipment. We use three ways to make this equipment resist the corrosion that may exist in your chemical plant:

**Selecting Metals.** For each kind of equipment, we choose the metal or alloy suitable for the application that will best resist corrosion. For example, nonferrous alloys are used liberally in making Type E turbines, Type V outdoor disconnecting switches and Ignitron rectifiers. Specially coated, heavy gauge steel is used on our Life-Line chemical motors.

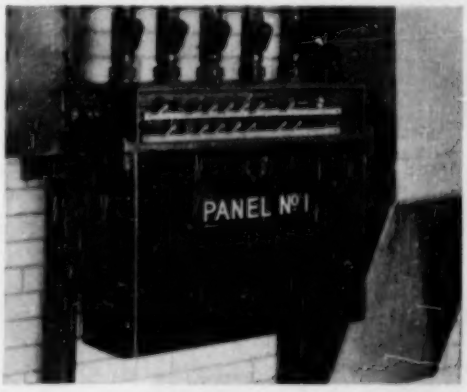
**Oil Immersion.** To give absolute protection against both corrosive and hazardous atmospheres, we make a wide variety of oil-immersed equipment. This includes oil-immersed power transformers, panelboards, circuit breakers, linestarters and pushbuttons.

**Protective Coatings.** To prevent corrosion from creeping back under the paint film when a scratch occurs, we Bonderize the enclosures of Westinghouse switchgear, transformers and control equipment. To further protect our outdoor switchgear from corrosion, we also give it an all-weather undersurface coating.

Westinghouse has Chemical Industry Specialists who will gladly help you with the solution of the electrical problems in your chemical plant.

Call your nearest Westinghouse District Office, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-94805




In this oil-immersed, nofuze "De-ion" breaker panelboard, each breaker is completely submerged in oil and operated by an external handle through a gland-type bushing. This provides a corrosion-resistant and explosion-proof panelboard.

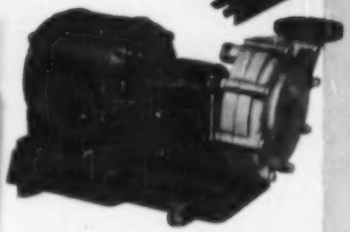
Westinghouse

EQUIPMENT FOR THE CHEMICAL INDUSTRY

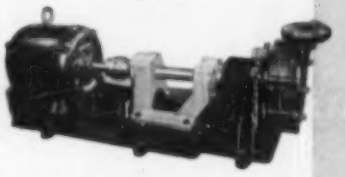
# ACE
## HARD RUBBER and PLASTICS

# STOP CORROSION AT ALL VITAL SPOTS

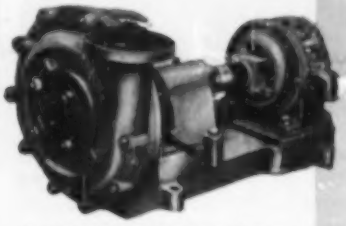
## For instance . . . ACE PUMPS for Every Need!



Hard Rubber Centrifugal Pump Type WAM, Motor Driven. Up to 80 gpm. capacity.

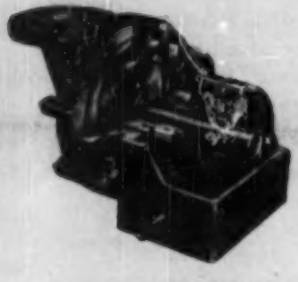


Hard Rubber Centrifugal Pump Type WAM, Motor Driven, Extended Base. Up to 80 gpm.

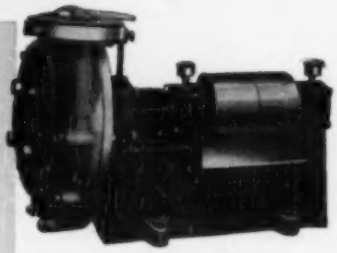


Hard Rubber Lined Centrifugal Pump Type WEFM, Motor Driven. Capacity to 350 gpm.

Ace hard rubber resists all alkalies, metallic salts of inorganic acids, hydrochloric acid any strength, nitric acid up to 16° Baume, phosphoric acid to 75%, sulphuric acid up to 50° Baume, most other inorganic acids any strength, and countless other corrosive solutions and fumes. Other Ace plastics such as Saran and Parian (polyethylene) extend this range of applications still further. Catalog 300-7 and Ace plastics bulletins tell you where Ace-clad and Ace molded equipment saves for you—send for them today.

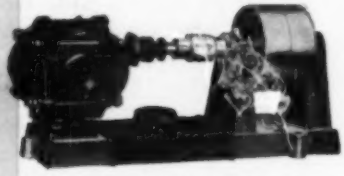


Cutaway view of Ace pump shows complete protection with Ace acid-resisting rubber.



Hard Rubber Lined Centrifugal Pump Type WEFB, Belt Driven.

Ace Hard Rubber Rotary Gear Pump, Motor Driven. Capacity 7 gpm.



Ace Hard Rubber Rotary Gear Pump, Belt Driven. Capacity 7 gpm.

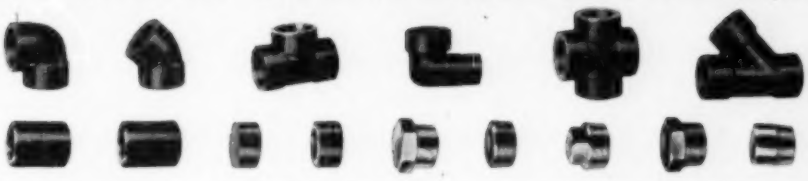
TO MARK PROGRESS

# Unrestricted Selection

## SEAMLESS WELDING FITTINGS—½ INCH THRU 30 INCHES

## FORGED STEEL FLANGES—½ INCH THRU 30 INCHES—LARGE O.D. THRU 96 INCHES

## FORGED STEEL FITTINGS—SCREWED AND SOCKET WELDING—⅛ INCH THRU 4 INCHES



*All Available in*

CARBON • ALLOY
STAINLESS STEELS
ALUMINUM
COPPER & OTHER
NON-FERROUS
METALS

A COMPLETE LINE PRODUCED UNDER ONE ROOF
... ONE RESPONSIBILITY

**LADISH CO.**

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

DISTRICT OFFICES: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland
Chicago • St. Paul • St. Louis • Atlanta • Houston • Los Angeles

**Standardizing on Ladish assures unrestricted selection in meeting your entire fittings requirements. Here, at one responsible source, you get all three . . . Seamless Welding Fittings, Forged Steel Flanges and Forged Steel Fittings . . . in a complete range of types, sizes and materials, plus the dependability obtainable only with Ladish Controlled Quality.**

# Quick Change

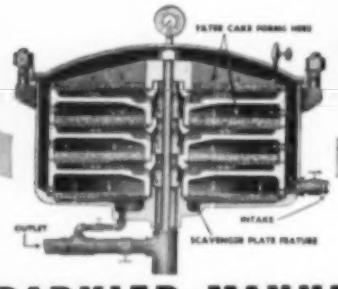
## ...of filter plates in SPARKLER FILTERS

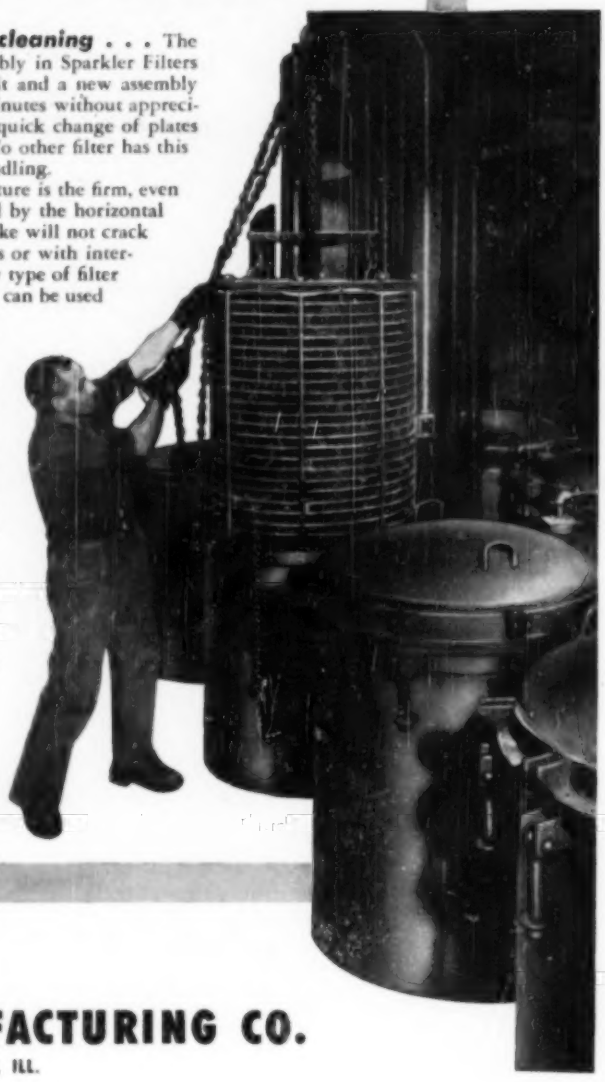
***means no shut-down for cleaning*** . . . The entire horizontal filter plate assembly in Sparkler Filters can be removed as a complete unit and a new assembly lowered into the filter in a few minutes without appreciable interruption in service. This quick change of plates is an exclusive Sparkler feature. No other filter has this unit assembly of plates for fast handling.

Another distinctive Sparkler feature is the firm, even support of the filter cake provided by the horizontal position of the plates. The filter cake will not crack or slip under variation in pressures or with intermittent operation of the filter. Any type of filter paper, cloth, screen, or filter media can be used without danger of breaking. There is no supporting strain on these materials.

Sparkler filters take up little floor space, are completely enclosed, and are available in stainless steel, mild steel, rubber lined, steam or brine jacketed, monel, nickel, or bronze. They are capable of efficiently handling practically any kind of liquid from thin alcohols to varnishes and resins.

Sparkler service includes laboratory test runs and engineering of continuous flow filtration for production line installations. Write, giving details of your filtering problem.



**SPARKLER MANUFACTURING CO.**

MUNDELEIN, ILL.

VESSEL DIVISION

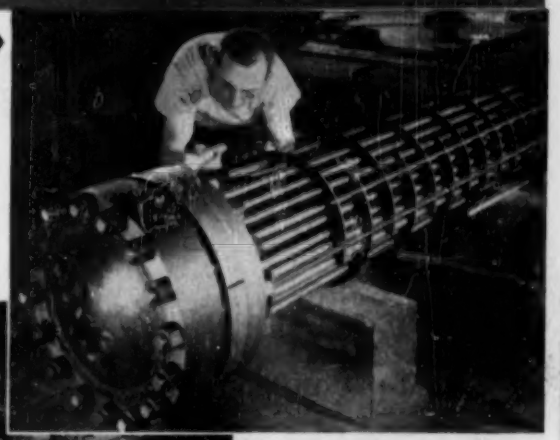
# NEWS

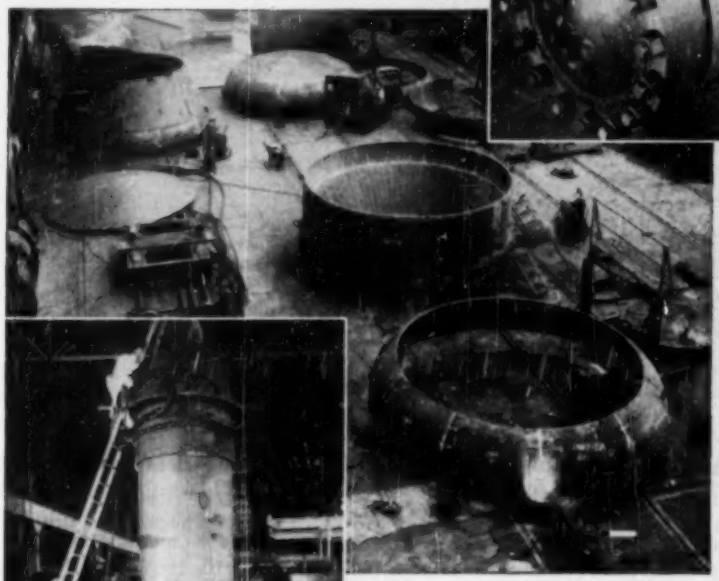
A.O. Smith 76th ANNIVERSARY 1874 - 1950

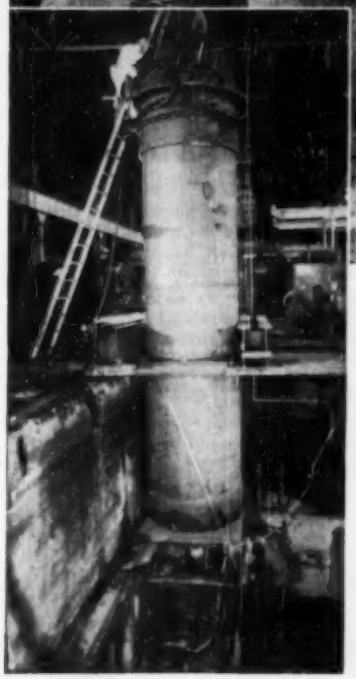
A.O.Smith
CORPORATION

New York 17 • Philadelphia 3 • Pittsburgh 19 • Atlanta 3 • Chicago 4,
Tulsa 3 • Dallas 1 • Houston 2 • Seattle 1 • Los Angeles 14
International Division: Milwaukee 1

**HEAT EXCHANGERS FOR HIGHER PRESSURES.** A. O. Smith solid-backing ring construction makes the split-ring floating head safe for higher pressures. Four exchangers, like the one shown here at the right, were built for one company and tested at 1875 lb. for a working pressure of 1250 lb.







**SHIPPING LIMITATIONS, PLANT LOCATIONS, OR BUILDING CLEARANCES ARE NO BARRIERS.** A. O. Smith can provide field-assembled vessels built and erected to shop-quality specifications. Shown at the left are part of the segmental cones and heads for six coke drums, to be field assembled. Each vessel will weigh approximately 220,000 lb. when completed.

**MULTI-LAYER VESSEL CONSTRUCTION FOR HIGHER PRESSURES.** This 24 ft. long by 4 ft. diameter Multi-Layer lined A. O. Smith Autoclave was given a running-in test in excess of the working pressure of 2,000 psi.

A. O. Smith Corporation, Dept. CE-150
Milwaukee 1, Wisconsin

Send the latest A. O. Smith Vessel Bulletins:

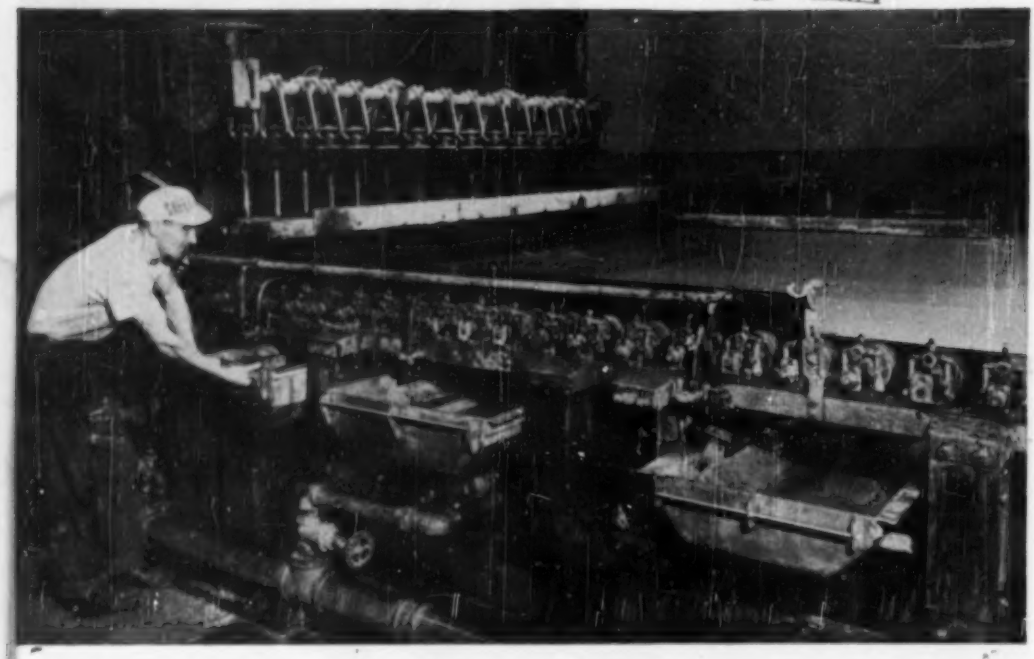
- ☐ V-46: Alloy, Alloy-lined, Clad, and Glass-lined Vessels
- ☐ V-44: Field Assembly of Pressure Vessels
- ☐ V-52: Multi-Layer Manufacture and Assembly

To: _____

Firm _____

Street _____ City _____ State _____

**FIBRE RECLAMATION IN PAPER MILLS** is a job being well done by ENDURO Stainless Steel. The water extracted from paper stock contains a high percentage of fibre. So that it may be returned to the paper machine system *uncontaminated*, it is collected in "Save-all Pans" of stainless steel. For practically every type of processing equipment, ENDURO is your assurance of no contamination.



# NO CONTAMINATION . . . Thanks to STAINLESS STEEL!

Paper making is one industry where soilage is spoilage. Profits themselves depend on strict cleanliness throughout the process. Republic ENDURO Stainless Steel . . . the metal that comes clean and stays clean . . . takes the worry out of fibre reclamation, as it does out of many a like job.

ENDURO has a high strength-to-weight ratio, resists corrosion, has high heat-resistance, requires little or no maintenance and has exceptionally long life. In addition to the profits it turns back into the business by prevention of product contamination, it pays a profit in its own right . . . through minimum maintenance cost, maximum on-the-job time and extended life. Its slightly higher initial cost quickly turns into profitable economy.

There are many analyses of ENDURO, each designed to meet the needs of specific applications. It will pay you to check with your equipment manufacturer or write to:

**REPUBLIC STEEL CORPORATION**

*Alloy Steel Division* • *Massillon, Ohio*

**GENERAL OFFICES • CLEVELAND 1, OHIO**

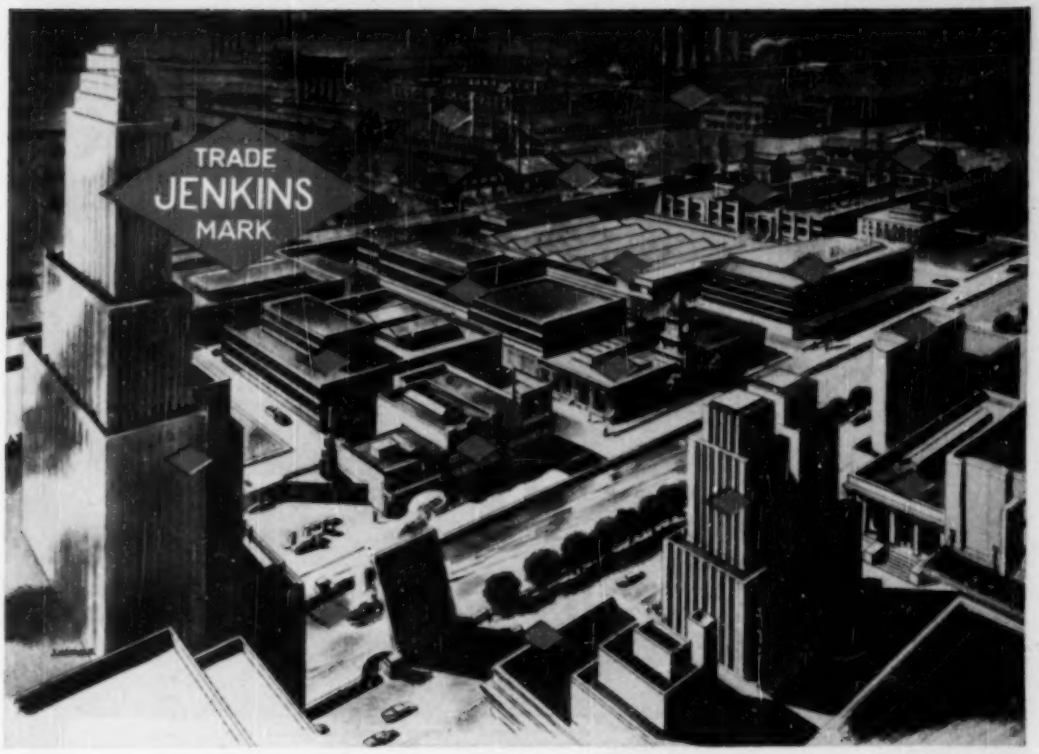
Export Department: Chrysler Building, New York 17, New York

*Enduro* **STAINLESS STEEL**

REG. U. S. PAT. OFF.

REPUBLIC STEEL

✓ *Check ALL 10 Advantages!* • RUST AND CORROSION-RESISTANCE • HEAT-RESISTANCE • HIGH STRENGTH • NO METALLIC CONTAMINATION • SANITARY SURFACES • EASY TO CLEAN • EYE APPEAL • EASY TO FABRICATE • LONG LIFE • LOW END COST.




# Acres of Diamonds

YOU SEE only the structures of commerce, soaring skyward . . . the strange new shapes of industry stretching beyond. Yet all around you are acres of diamonds. Diamonds that identify the thousands of Jenkins Valves on duty in the many different types of buildings essential to modern civilization.

Nothing holds its value like the diamond, in valves as in gems. Four generations of American builders have placed their trust in the Jenkins diamond and signature trade mark. Today, as in 1864, Jenkins Valves are the choice of men who plan shrewdly, always with an eye to future maintenance and operating costs.

*They* know that Jenkins builds extra endurance into Valves — proved by long life and low upkeep cost records in every type of service. They know, too, that there is extra value in the *experience* Jenkins Valve specialists can apply to any question of selection, installation, or maintenance.

*You pay no more* for Jenkins Valves, despite their superior quality and service. So why not let the Jenkins diamond serve as your guide to valve economy . . . for new installations, for all replacements. *Sold through leading Industrial Distributors everywhere.*

JENKINS BROS.

80 White St., New York 13;
Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago;
San Francisco. Jenkins Bros., Ltd., Montreal.

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

BWH

DEPENDABLE RUGGEDNESS

# BULL DOG V-BELTS demonstrate how to get the most out of V-Belts

Fractional Horsepower (FHP)—V-Belts in three standard sections, full range of lengths.
WEAR-RESISTANT COVER, protects heart of belt from dirt, grease, moisture.
COMPRESSION SECTION, engineered to withstand continual flexing.
BULL DOG CORDS, powerful load-carrying section.
Industrial V-Belts in A, B, C, D and E sections — full range of lengths from 26"-440".

## OUTSTANDING ADVANTAGES OF BULL DOG V-BELTS

1. **Fewer Maintenance Headaches.** Because BULL DOG V-BELTS require less adjusting and last longer, they save time, money and worry in maintenance.

2. **Longer Belt Life.** Because new, quality-controlled compounds developed in BWH laboratories run cool, don't crack or deteriorate under severe flexing.

3. **Backed by BWH Reputation for Extra Service.** In the 72 years that BWH has been a leader in the mechanical rubber manufacturing field, BWH products have built steady fame for outstanding performance. BULL-DOG V-BELTS fully live up to BWH reputation for dependable ruggedness.

**Efficient V-Belt operation insures steady, smooth, low-cost power transmission, without maintenance worries, over long periods of time. And that's exactly the kind of economical, worry-free service BULL DOG V-BELTS deliver in all types of industry.**

**Each job has its own problems, however. Here are some of the common ones that engineers report in V-Belt operation, with BWH solutions:**

| PROBLEM | SOLUTION |
|---|---|
| Excessive Cover Wear on V-Belts | Check sheaves for worn grooves. Check alignment between sheaves. Check to see that sheaves are tight on shafts. |
| Covers Loosen . . Rubber Gets Soft and Sticky | Check for excessive oily conditions. If contact with oil or grease cannot be prevented, then specify BULL DOG HSO V-BELTS, which are oil resistant. (Also heat resistant and static conducting.) |
| V-Belts Failing Within Few Hours of Installation | This is usually caused by prying V-Belts over edge of sheaves, causing internal cords to break. Correct method of installation is to move motor of driven machine until belts do not have to be forced onto sheaves. Then move motor back until sufficient tension is applied. |
| New V-Belt Installed As Replacement Fails, While Old Belts Continue Running | Never install a new belt in a set of old belts, because it will be either shorter or longer than the old belts. If shorter, it will be excessively overloaded and fail. If longer, it will not transmit an equal share of the load. Always install a complete new set of belts and retain old belts for an emergency, or for temporary replacement if needed. |

It will pay you to investigate BULL DOG V-BELTS on your next installation. They have what it takes for smoother operation on both FHP motors and on high-powered industrial jobs.

**HAVE YOU A JOB WHERE STAMINA COUNTS?**

Bring us your toughest problems. We're specialists in solving them. Consult your nearest BWH distributor or write us direct.

**FOR ALL MECHANICAL RUBBER GOODS CONSULT BWH**

Established in 1878, BWH is today one of the world's largest manufacturers of mechanical rubber goods. Among the quality-famous BWH products which are today helping industry to do better jobs at lower cost are the following:

| | |
|---|---|
| CONVEYOR BELTING | OIL INDUSTRY HOSE |
| ELEVATOR BELTING | STEAM HOSE |
| TRANSMISSION BELTING | WATER HOSE |
| AIR HOSE | OIL FIELD SUPPLIES |
| CONTRACTORS' HOSE | FRICTION TAPE |
| FIRE HOSE | SPLICING COMPOUND |

BWH DEPENDABLE RUGGEDNESS

Another Quality Product of

**BOSTON WOVEN HOSE & RUBBER COMPANY**

Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS., U.S.A. • P.O. BOX 1021, BOSTON 3, MASS., U.S.A.

# How to choose high temperature tubes for the best LIFE/COST ratio

**TIMKEN 18-8 STEEL TUBES** Shows the best combination of creep strength, oil corrosion and oxidation resistance up to 1500°F.

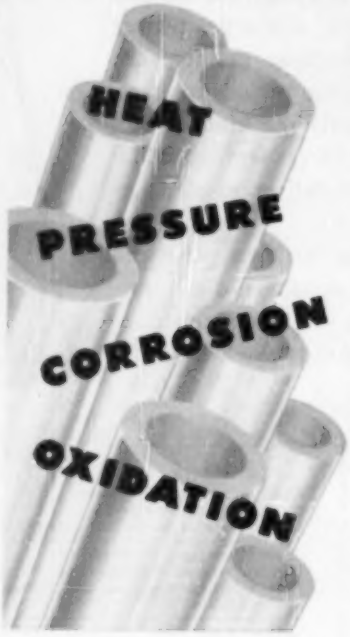
**TIMKEN SICROMO 9M STEEL TUBES** This steel possesses the maximum corrosion resistance of any of the steels below the stainless group.

**TIMKEN SICROMO 7 STEEL TUBES** For applications requiring better corrosion resistance than can be obtained with 5% Chromium type steels.

**TIMKEN SICROMO 5 S STEEL TUBES** For oxidation resistance to 1500°F. Good creep strength and corrosion resistance to 1300°F.

**TIMKEN 4-6% CR MO STEEL TUBES** For service up to 1200°F. Superior corrosion resistance. Less oxidation resistance than Sicromo 5.

**TIMKEN SICROMO 3 STEEL TUBES** For service up to 1200°F. Have excellent oxidation resistance and good corrosion resistance.




**TIMKEN 2¼% CR-1.0% MO STEEL TUBES** For service up to 1150°F. Has greater resistance to creep than 2% Cr. ½% Mo. Steel.

**TIMKEN SICROMO 2 STEEL TUBES** For service up to 1200°F., where better scale resistance is required than can be obtained with 2% Cr. ½% Mo. Steel.

**TIMKEN 2% CR-½% MO STEEL TUBES** For service up to 1150°F. Intermediate corrosion resistance plus good creep strength, fair oxidation resistance.

**TIMKEN DM STEEL TUBES** For service up to 1150°F. This steel offers outstanding creep strength.

**TIMKEN CARBON-MO STEEL TUBES** For temperature up to 1000°F. Improved creep strength makes it safer than carbon steel.

**TIMKEN CARBON STEEL TUBES** Generally for service not exceeding 900°F., where corrosion and oxidation resistance are not important.

THERE may be more than one of these 12 Timken® steels that provides the answer to your specific heat, pressure, corrosion, or oxidation problem. But only *one* will assure you of maximum service life per dollar invested.

How can you be sure which of these 12 steels will give you the best life/cost ratio? Let our Technical Staff analyze your needs. With 19 years of experience and research in high temperature tubing applications, our metallurgists are qualified to recommend the right steel to give you the service life you need at the lowest cost. Our Technical Staff, recognized authorities in the field, will be glad to assist you in making the most economical choice of high temperature tubes.

Whichever of these analyses is selected, you can be certain of uniform high quality from tube to tube and shipment to shipment. Careful quality control through every production step assures you of uniformity every time.

To help you choose the tube that gives you the best life/cost ratio, call on our Technical Staff now. For further information on high temperature tubing, write or wire The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

**YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH**

*Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing*

RESINS

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RESIN SOLUTIONS

COAL-TAR SOLVENTS

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Chemicals

*For The Nation's Vital Industries* ★

*Ask for new Price List*

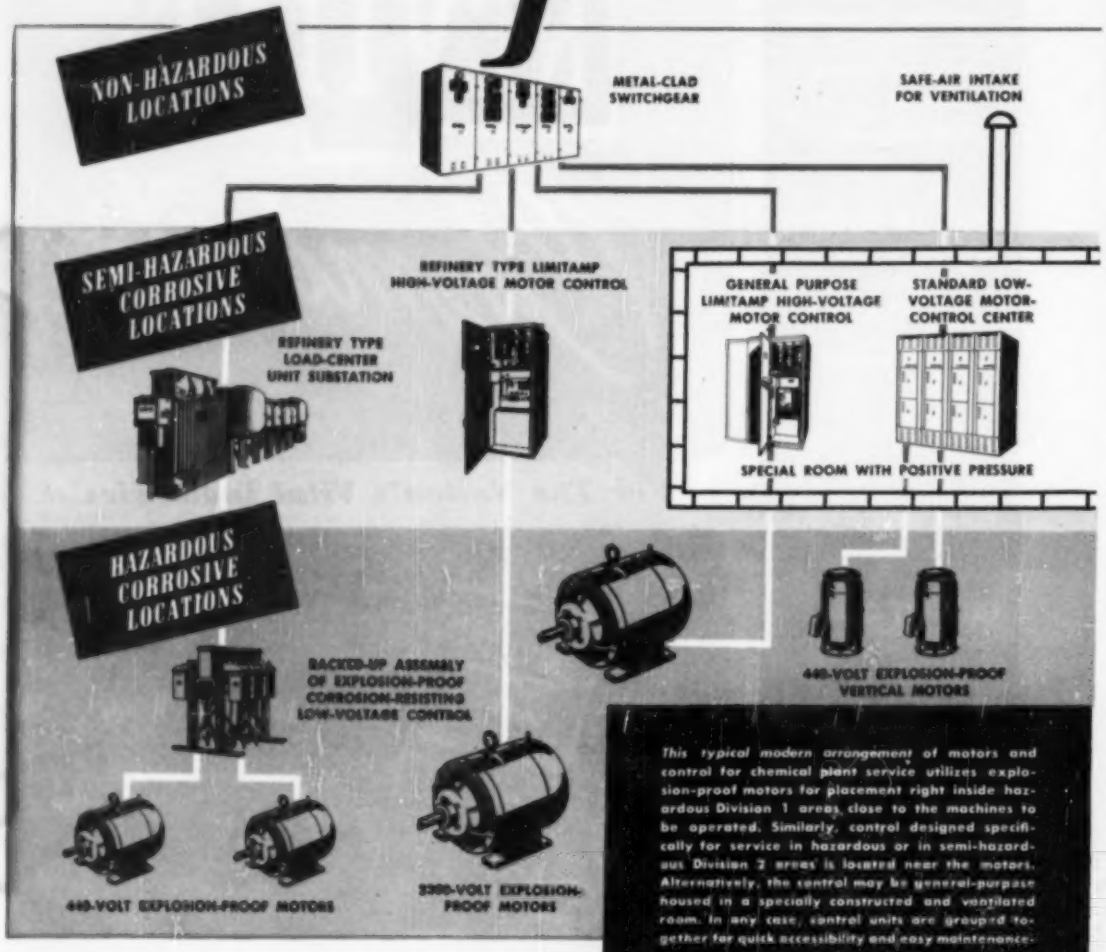
This new price list also gives description and characteristics of *Neville* quality products, designed to serve various industrial needs.

**THE NEVILLE COMPANY**

PITTSBURGH 25, PA.

A-34

## What's the trend in chemical plant electrification? } wider use of explosion-proof


NON-HAZARDOUS LOCATIONS
METAL-CLAD SWITCHGEAR
SAFE-AIR INTAKE FOR VENTILATION
SEMI-HAZARDOUS CORROSIVE LOCATIONS
REFINERY TYPE LIMITAMP HIGH-VOLTAGE MOTOR CONTROL
REFINERY TYPE LOAD-CENTER UNIT SUBSTATION
GENERAL PURPOSE LIMITAMP HIGH-VOLTAGE MOTOR CONTROL
STANDARD LOW-VOLTAGE MOTOR-CONTROL CENTER
SPECIAL ROOM WITH POSITIVE PRESSURE
HAZARDOUS CORROSIVE LOCATIONS
RACKED-UP ASSEMBLY OF EXPLOSION-PROOF CORROSION-RESISTING LOW-VOLTAGE CONTROL
440-VOLT EXPLOSION-PROOF VERTICAL MOTORS
440-VOLT EXPLOSION-PROOF MOTORS
2300-VOLT EXPLOSION-PROOF MOTORS

*This typical modern arrangement of motors and control for chemical plant service utilizes explosion-proof motors for placement right inside hazardous Division 1 areas close to the machines to be operated. Similarly, control designed specifically for service in hazardous or in semi-hazardous Division 2 areas is located near the motors. Alternatively, the control may be general-purpose housed in a specially constructed and ventilated room. In any case, control units are grouped together for quick accessibility and easy maintenance.*

## Here's what you need in motors and control for hazardous areas! }

**WHEN YOU COME TO GENERAL ELECTRIC you get far more than the finest in electrical equipment. A General Electric application engineer, familiar with chemical plant practice, is at your disposal. If desired, he stands ready to take over the job of co-ordinating all the needed components, engineering your power distribution and utilization equipment into one modern efficient system.**

# *corrosion-resisting* **motors and grouped controls**

***— to simplify plant layouts, cut special construction costs!***

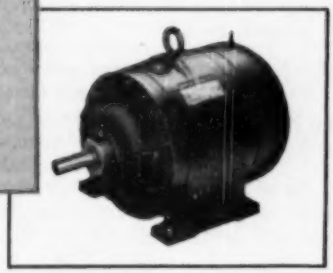
There are more ways than one, of course, to meet hazardous chemical-plant conditions. But because it best combines simplicity, security, and savings, today's trend is toward greater use of explosion-proof, corrosion-resisting motors and group installation of control centers.

Its advantages? Motors and control can be located solely with reference to convenience, accessibility for maintenance, economy of space, and driving machinery. And because it's standard equipment, initial cost is lower.

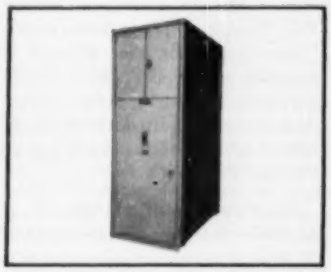
By minimizing explosion hazards, you promote personnel safety and continuity of production. Moreover, you can take full advantage of the cost-saving benefits of the load-center system of power distribution. Full information on motors and control for hazardous areas is contained in Bulletin GEA-4131. We'll gladly send you a copy. ***Apparatus Dept., General Electric Company, Schenectady 5, N. Y.***

Have you seen the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution"? Ask your G-E representative to arrange a showing for your organization.

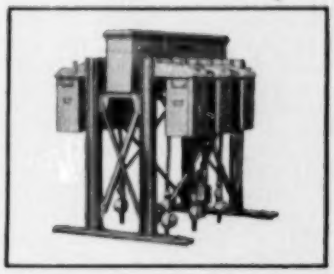
**To meet chemical plant conditions** and code requirements for hazardous areas, General Electric builds the most extensive line of explosion-proof motors on the market, in the widest variety of types, sizes, and ratings, and for the greatest number of hazardous conditions. In high- and low-voltage control, too, you have an unusually broad range to select from, made especially for use in hazardous and corrosive atmospheres. Let an experienced G-E engineer help you select the right combination for *your* special needs. Take the first step now—just call him at your nearest G-E office.



**G-E Tri-Clad** explosion-proof motors for Class I Group D hazardous locations have strong cast-iron frames and end shields. Non-sparking Textolite cooling fans standard on smaller sizes for greatest corrosion resistance.



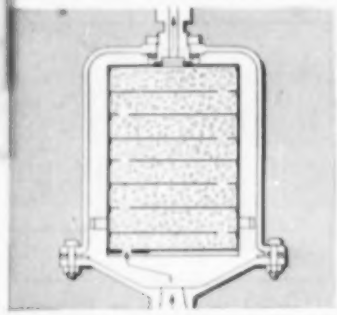
**G-E Limitamp** high-voltage motor controls for semi-hazardous Class I Group D Division 2 areas—factory-assembled, space-saving units—give adequate short-circuit protection with high-IC current-limiting fuses.



**G-E low-voltage control** for hazardous Class I Group D Division 1 areas—in these convenient, racked-up standard assemblies of combination starters and breakers—save installation time, simplify maintenance.

GENERAL ELECTRIC

## ALCOA ALUMINA MAKES FIRE PROTECTION POSITIVE



It is mighty important to know that your automatic sprinkler and alarm equipment is going to work when you need it—*in case of fire!* That is why "Automatic" Sprinkler Corporation of America builds protection-plus into the devices and systems which they expressly design for the purpose of safeguarding lives and property.

One of the "protectors" is a canister of ALCOA Activated Alumina that stands guard over the air in the "supervisory" air line. *Dry* air is essential to keeping valves free—especially in freezing temperatures. Any new air admitted to this line is robbed of its moisture as it passes through the alumina.

Since only small amounts of air are added to the system, the ALCOA Activated Alumina *requires no reactivation* or attention.

This manufacturer chose ALCOA Activated Alumina, because he wanted a *thoroughly reliable*, non-corrosive drying agent—a drying agent that would not change its form or properties—swell, soften or disintegrate.

It is properties such as these, plus uniform high purity and inertness, that give ALCOA Activated Alumina its wide acceptance as an outstanding drying agent. (And as a catalyst support, too.)

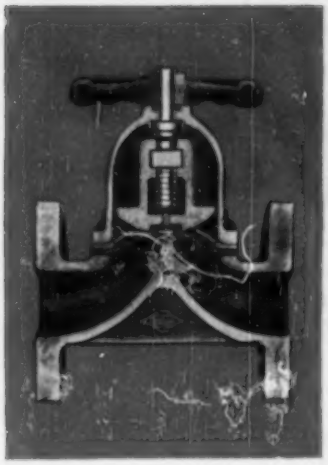
If you have a drying problem, let us give you *all* the facts about ALCOA Activated Alumina. Write to: Aluminum Company of America, Chemicals Division, 602A Gulf Building, Pittsburgh 19, Pa.

ALCOA

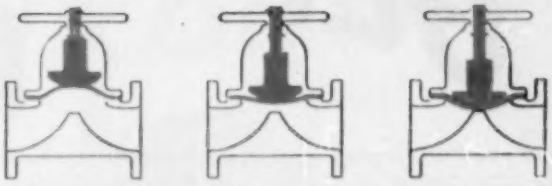
# ALCOA CHEMICALS

## ALUMINAS AND FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • LOW SODA ALUMINAS • TABULAR ALUMINAS • HYDRATED ALUMINAS
ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE

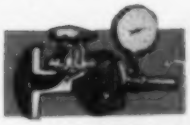


# If you need a diaphragm valve you need all the advantages of diaphragm closing



## Check these popular features of

# GRINNELL-SAUNDERS DIAPHRAGM VALVES



**Diaphragm gives leak-tight closure against grit, scale, solid matter . . .** Even when something as substantial as an 8-penny nail is trapped on the weir of a rubber lined valve, as illustrated, the resilient diaphragm, plus the large area of contact, gives leak-tight closure against pressure or vacuum.

**Diaphragm lifts high for streamlined flow in either direction . . .** Smooth, streamlined passage, without pockets, prevents trapping of sludge and reduces frictional resistance to a minimum—irrespective of direction of fluid flow. No disc holder in fluid stream. Grinnell-Saunders Diaphragm Valves are self-draining when installed with the spindle at 15 degrees above the horizontal position.

**Diaphragm absolutely isolates working parts from fluid . . .** There's no "if" about the way a continuous, one-piece diaphragm seals off the working parts from fluids; no perforation or puncture in the diaphragm where fluid or gas can possibly leak by the valve spindle. No sticking, clogging or corroding of working parts. Valve lubricant cannot contaminate the fluid in the line.

**Diaphragm, body and lining materials to meet particular conditions . . .** Bodies stocked in cast iron, malleable iron, stainless steel, bronze and aluminum: other materials on special orders. Valve bodies lined with lead, glass, natural rubber or neoprene. Diaphragm materials of natural rubber or synthetics. Working pressure, 150 lbs.; maximum temperature, 180°F.

**Diaphragm is only part that normally wears and needs replacement . . .** Depending on the type of service, it may last for years, particularly since the compressor and finger plate combine to support the diaphragm in all positions. The diaphragm can be replaced quickly without removing valve from line. No refacing or reseating. No disc holder to require tightening or replacing. No packing glands to demand attention.

*Write today for the new Grinnell-Saunders Diaphragm Valve Catalog 4-B.*

# GRINNELL

Grinnell Company, Inc., Providence 1, R. I. Warehouses: Atlanta • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

## In Modernization, FLEXIBILITY COUNTS

# GET POWER WITH

*In plants where modernization programs frequently require shifting of equipment from place to place, drives with flexibility of application are a "must". This is one more reason why General Electric's STANDARD line of mechanical-drive turbines is winning such favor with progressive industries. The DP turbine can be easily transferred from one job to another, its speed and range changed easily, its horsepower rating adjusted economically.*

## DP TURBINES PROVIDE FLEXIBILITY THREE WAYS

### 1. EASY TO RE-LOCATE

Shaft height is the same on all G-E standard single-stage turbines. This means that moving turbines from one job to another doesn't require a "custom line-up job." Not only shaft height, but size of coupling fit and keyways are standard on every unit.

DP turbines are quickly aligned, too. Unless casing temperatures are high, DP's can be lined up cold with the assurance that shaft lift will be within allowable limits when the turbines are heated. Such easy alignment is possible only on a center-line supported unit.

### 2. EASY TO ADJUST SPEED

By adjusting a simple handwheel, the speed setting can be varied within a 30% range. Once adjusted, the DP's hydraulic governor holds speed accurately.

If a change in application makes a new speed range necessary, the range can be set anywhere from 800 to 5000 rpm by simply substituting a new emergency governor and a new set of low-cost gears on the governor drive. These gears are standard, available on immediate delivery from the factory.

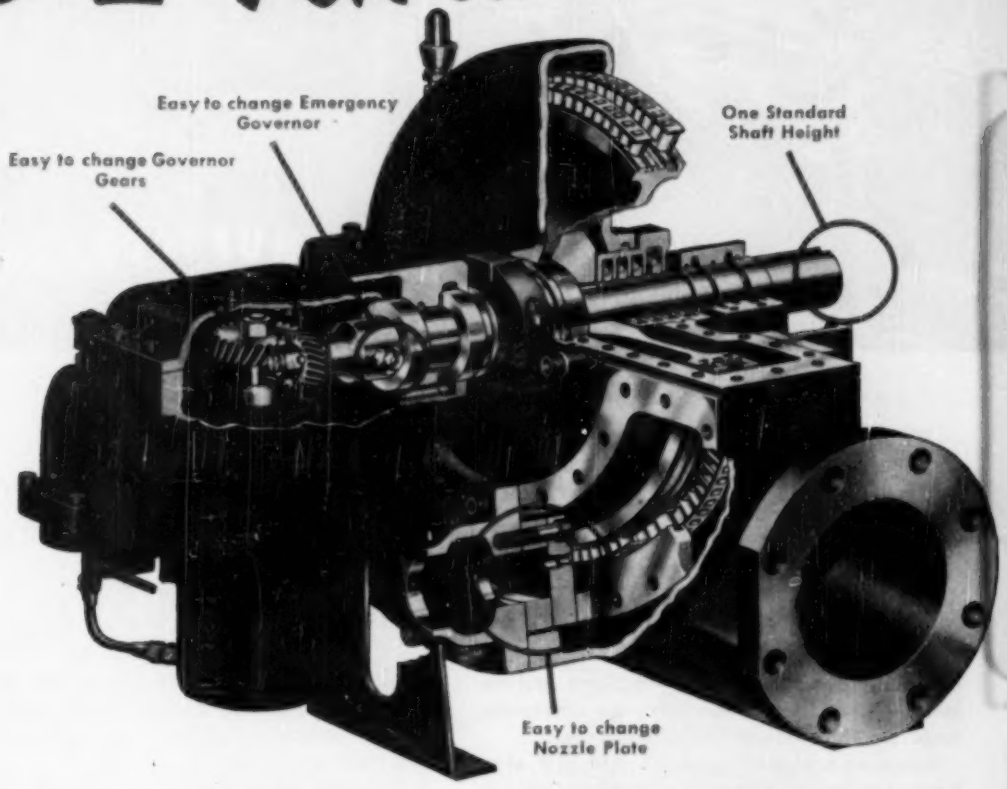
### 3. EASY TO CHANGE RATING

When steam conditions or load demands change, a DP turbine can be adapted at a reasonable cost for the new requirements if they are within the steam flow capacity of the casing. Example: If it is desired to increase the horsepower rating, the only changes which are usually necessary are new nozzle plate and valve parts. The cost of such parts is far less than the cost of a new turbine—which would be required with a less flexible unit.

## REMEMBER...

**"DP means Dependable Power"**

# FLEXIBILITY G-E TURBINES




The General Electric standard DP Turbine incorporates many outstanding features previously found only on "special" turbines. They give you a drive which is dependable and flexible—ideal for a variety of applications in your plant.

For the full story on how these features can mean operating benefits for you, call your G-E representative. Or write today for GEA-4955, a 20-page, descriptive bulletin. Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

252-45

BEING USER AS WELL AS MANUFACTURER

# MIDWEST

## HAS THE "Customer's Viewpoint"

# ON PIPE WELDING FITTINGS

The four Midwest pipe fabricating plants, and the Midwest Contracting Department are among the large users of Midwest Welding Fittings.

Hence, we have the "customer's viewpoint" when it comes to welding fittings. We know from our own experience what characteristics welding fittings must have to simplify piping layout . . . to reduce welding time . . . to improve piping design. The welding fittings manufacturing department always has the benefit of our extensive user experience.

This situation is one important reason for the high quality and exceptional practicality of all Midwest Welding Fittings. Also important are the laboratory control of manufacturing procedures and the program of continuous research in piping and welding problems.

For more information about Midwest Welding Fittings, get in touch with the local distributor or our nearest office.

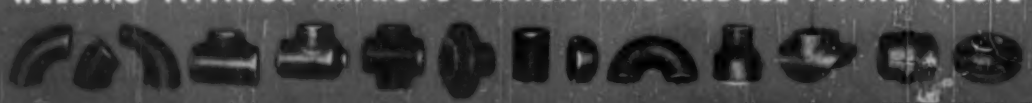
**MIDWEST PIPING & SUPPLY CO., Inc.**

**Main Offices: 1450 So. Second Street, St. Louis 4, Mo.**

**Sales Offices: New York 7—30 Church St. • Chicago 3—79 W. Monroe St. • Los Angeles 33—320 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • South Boston 27—426 First St.**

**Stocking Distributors in All Principal Cities**

WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS



# NO "FREEZE-UP" with YARWAY TRAPS

Troubled with outdoor steam traps freezing? Solve the problem the way Thermoid did at their Trenton, N. J., plant.

They installed Yarway Impulse Steam Traps on coal handling equipment. Now, though temperatures dip to zero and snows pile high, their traps never freeze.

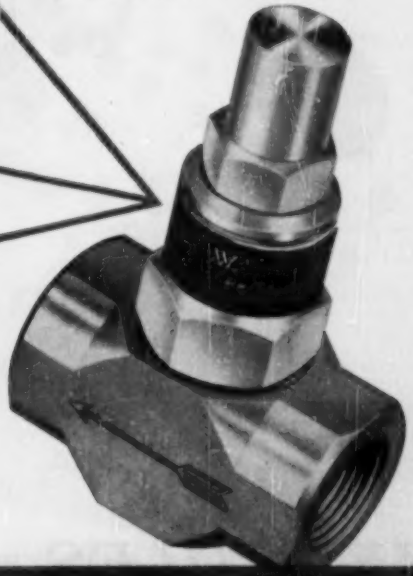
Condensate does not accumulate in Yarway Impulse Traps. The only moving part—a little valve—floats on the load. It discharges condensate as it comes through, instead of waiting for a quantity to accumulate. Hence—nothing to freeze.

Add to that, Yarway Traps' reputation for low maintenance, quick heating, easy installation, and economy of operation and you have reasons why over 600,000 Yarways have already been bought.

Often it costs less to install new Yarways than to repair old type traps. See your nearest Mill Supply Dealer. For his name, and free Yarway Trap Book, write . . .

**YARNALL-WARING COMPANY**
**137 Mermaid Avenue, Philadelphia 18, Pa.**
*Branch Offices in Principal Cities*

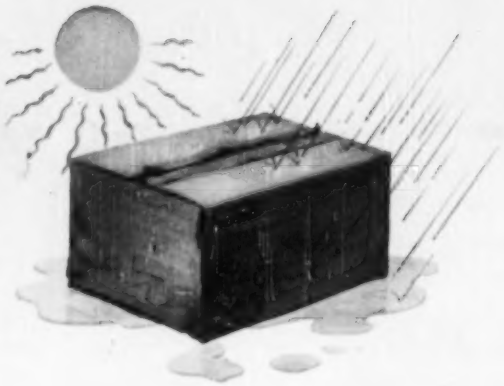
Yarway Traps beat the worst weather in this installation at Thermoid's Trenton plant.



**YARWAY** **IMPULSE STEAM TRAP**

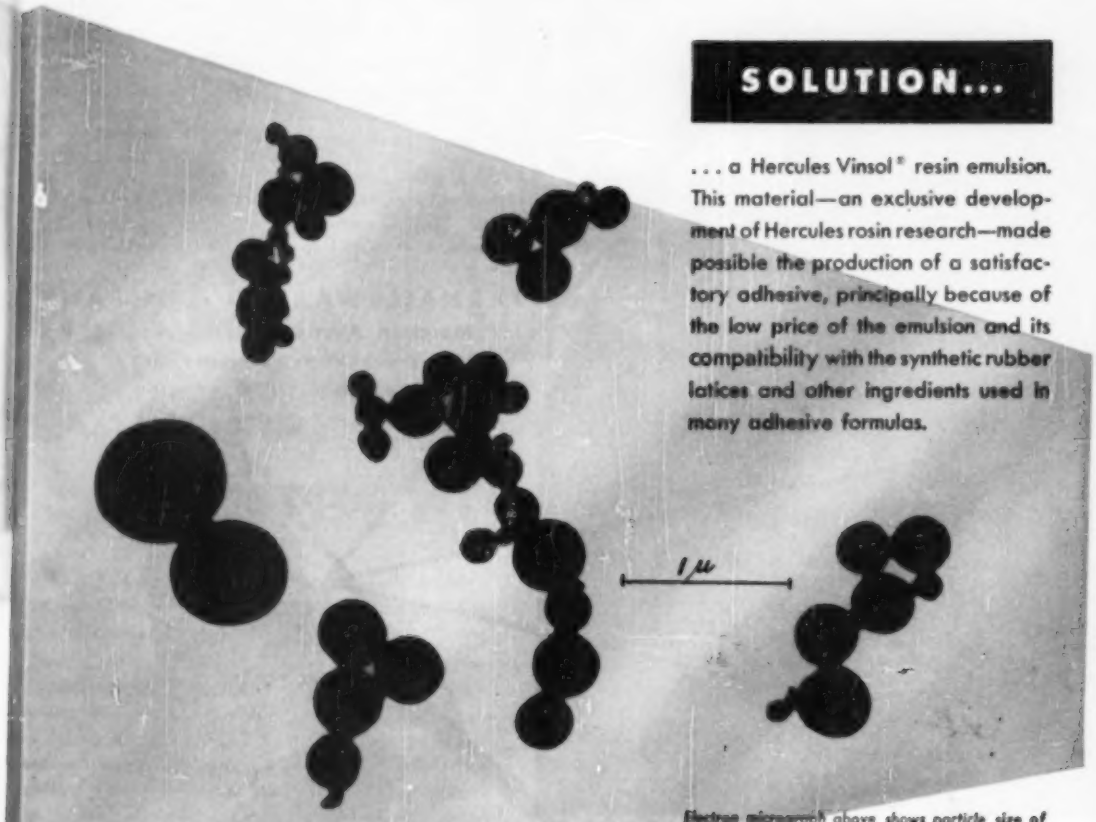
## PROBLEM...

... to produce an adhesive for paperboard shipping containers which would withstand moisture, heat, weathering, and other conditions encountered in export shipping.



## SOLUTION...

... a Hercules Vinsol® resin emulsion. This material—an exclusive development of Hercules rosin research—made possible the production of a satisfactory adhesive, principally because of the low price of the emulsion and its compatibility with the synthetic rubber latices and other ingredients used in many adhesive formulas.




*Electron micrograph above shows particle size of "Vinsol" emulsion, 31,000 magnification.*

**HERCULES** SYNTHETIC RESINS · CELLULOSE PRODUCTS · TERPENE CHEMICALS

**WHAT'S THE FORMULA FOR STICKINESS?** Here's how one manufacturer found out. Working with the newer synthetic rubbers, he found his answer in Hercules rosin research. The particular product for his needs, "Vinsol" resin, is available in emulsion, solution, and other forms and modifications, and offers many potentialities for other adhesive and laminating uses.

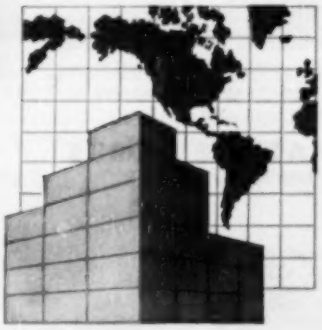
"Vinsol" is versatile as well as economical. It is used in binders for rock wool and glass wool insulating batts. It acts as an emulsifier or stabilizer in asphalt emulsions, as an air-entraining agent and plasticizer in cements. It's fine as a stiffener for paperboard, a low-cost replacement for phenolics in many uses, and suitable for certain electrical insulation applications.

Let us tell you more about "Vinsol" and the many other Hercules chemical materials that are serving industry. We would like to work with you to find new and cost-saving solutions to your processing problems.

*HERCULES POWDER COMPANY*
INCORPORATED
952 Market Street, Wilmington, Delaware
*Sales offices in principal cities*

**RESULT...**

. . . an economically-produced, easy-to-apply adhesive which has proved successful under all conditions of overseas shipping and handling. Today, one of its applications is for the food and clothing packages shipped abroad by CARE.



"VINSOL," "CELLOLYN," "PARLON," AND "HERCOFLEX" ARE HERCULES TRADE-MARKS

### Fortifier for Alkyds

If alkyd enamels are fortified with "Parlon" (Hercules chlorinated rubber), they dry faster and develop a harder film. In many formulations, "Parlon" improves chemical resistance and tint and gloss retention. These "Parlon"-fortified enamels can be air dried, force dried, or baked.

### Whiter Baking Whites

Interested in making better white baking enamels? Cellolyn® 502 is a synthetic resin specially developed for the job. When used with amino formaldehyde resins, it offers an outstanding combination of good color stability and gloss even at high oven temperatures. It is also valuable in pale or clear nitrocellulose lacquers, where it contributes good initial color and excellent color retention.

### New Vinyl Plasticizer

A new vinyl resin plasticizer with important properties, "Hercoflex" 150 (octyl decyl phthalate), is now commercially available in limited quantities. "Hercoflex" 150 is manufactured from a blend of straight chain alcohols specifically chosen to yield distinctly superior low-temperature performance coupled with unusually low volatility. It is available at no premium in price over other widely used phthalate plasticizers for vinyls.

### Secondary Recovery First

Of particular interest to secondary recovery oil-well operators is Hercules Rosin Amine D Acetate. Known as "RADA," this surface-active, water-soluble, organic amine salt is being used successfully as a corrosion inhibitor and to control bacteria in water-flooding systems.

### Self-extinguishing Thermoplastic

A heat- and flame-resistant cellulose acetate molding material is now on the market. The first thermoplastic of its type, this new material offers all the features of regular cellulose acetate: toughness, rich color, light weight, good electrical insulation, and dimensional stability—plus the important advantage of being a truly self-extinguishing material which can be injection molded. It is being used successfully for many Underwriters'-approved electrical products.

**ROSIN AND ROSIN DERIVATIVES • CHLORINATED PRODUCTS • AND OTHER CHEMICAL MATERIALS FOR INDUSTRY**

GC50-1

**"This Steam Trap is unconditionally guaranteed to satisfy you!"**

**YOU CAN'T LOSE**

**SAVED 3728 GALLONS OF FUEL OIL** in one year after replacing old traps with Armstrong on kettles, low pressure heating system and cream beaters.—*Mary Lincoln Candies, Buffalo, New York.*

**30% LESS MAINTENANCE** with Armstrong traps on heating and steam distribution system.—*John Deere Harvester Works, East Moline, Ill.*

**COOKING KETTLE OUTPUT SPEEDED UP 30%** by Armstrong trapping on each steam jacketed kettle.—*Bulman's Ltd., Vernon, B. C.*

EVERY Armstrong steam trap is guaranteed to be free from defective workmanship or material, to function perfectly, to fulfill all claims in every respect and to give complete satisfaction.

ONLY A GOOD STEAM TRAP COULD *POSSIBLY* BE PACKED BY SUCH A GUARANTEE! To save fuel, to reduce maintenance, to get more work out of existing equipment, to get complete steam trap satisfaction, ask your nearby Armstrong representative to discuss with you the traps you need now.

**ARMSTRONG MACHINE WORKS**
858 Maple St., Three Rivers, Mich.

SEND FOR YOUR COPY OF THE 36-PAGE ARMSTRONG STEAM TRAP BOOK explaining the design and workmanship that make the Armstrong guarantee possible. Complete data on the selection and installation of traps for all classes of equipment. Free on request.

# ARMSTRONG STEAM TRAPS

# Air Casualties

***It's bad air that does it. But you can step up production by putting a Coppus Blower on the job to keep the air moving — and keep the men cool.***

The kind of air a man works in has a lot to do with how much work he can turn out.

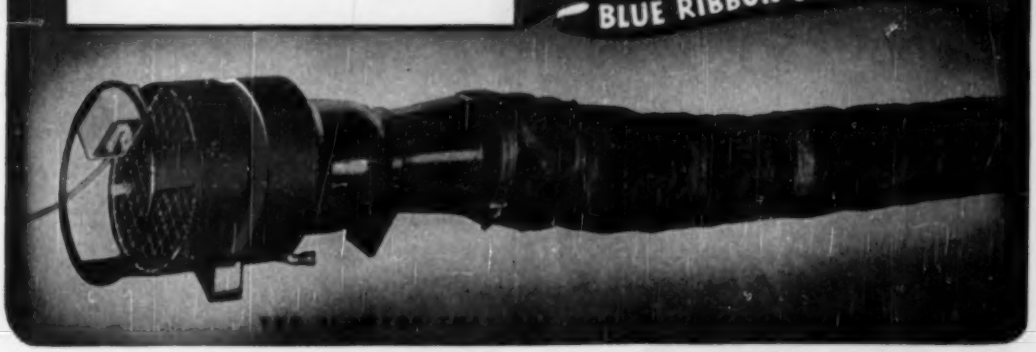
In confined places like shipholds or tanks or drums or boilers . . . or wherever the air is stagnant or hot or full of fumes . . . a Coppus Blower is a *must* for getting first-class work out of the men, all the time.

A Coppus Blower or Exhauster helps avoid sickness and lassitude due to bad air . . . and improves morale, too.

Portable and adaptable for special purposes, Coppus Blowers and Exhausters will have dozens of uses around your plant. The "Blue Ribbon" (a blue painted band) is your assurance of quality performance at lowest cost.

# COPPUS

BLUE RIBBON BLOWERS



**CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU**

***MAIL THIS COUPON*** To Coppus Engineering Corp., 221 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY.

**PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:**

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fuselages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets, etc., after treated with coating material.

NAME .....

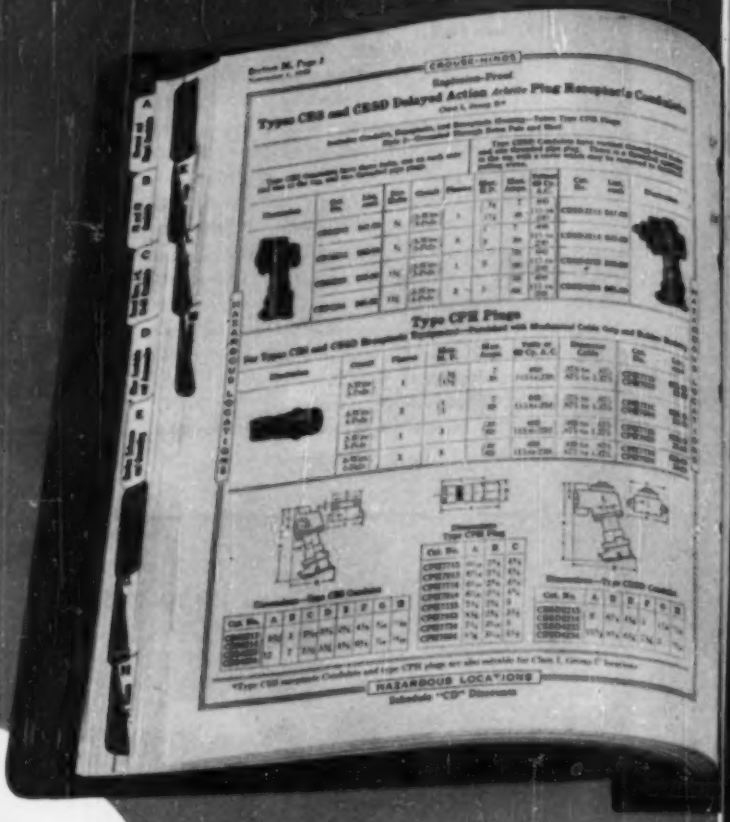
COMPANY .....

ADDRESS .....

CITY .....

(Write here any special ventilating problem you may have.)

# CROUSE-HINDS *Announces a*



## . . . with many

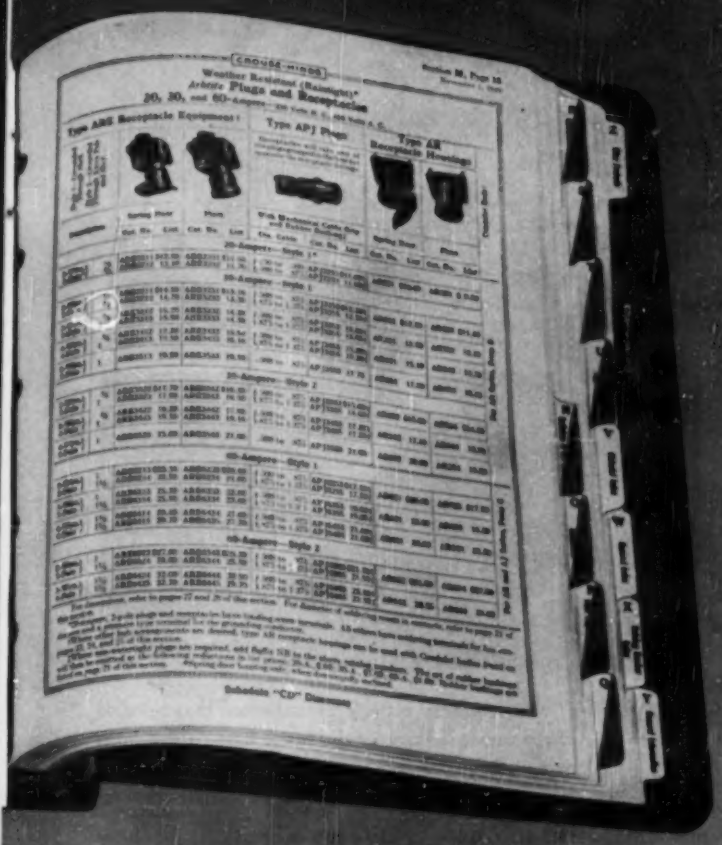
The many improved features in this catalog are the result of our years of cataloging experience combined with helpful suggestions from users of our products.

Among the outstanding features of the catalog are the logical divisions of Condulets into sections, the arrangement of the Condulets within the sections and the colored index tabs which simplify its use. For example, Section S contains listings of Condulets for industrial control. Section K contains listings of lighting fixtures

**CONDULETS • TRAFFIC SIGNALS**

# *NEW* CONDULET Catalog

**No. 3000**




CONDULET

First in the field

STANDARD OF QUALITY

## NEW features for your convenience

for general illumination. Section T contains listings of circuit breaker Condulets.

BUFF index tabs identify Condulets for use in non-hazardous locations.

RED index tabs identify Condulets for use in hazardous locations.

Combined RED and BUFF tabs identify Condulets for use in both hazardous and non-hazardous locations.

These features make this catalog a convenient reference book from which to select proper Condulets for required applications.

**CROUSE-HINDS COMPANY**

Syracuse 1, N. Y.

Offices: Boston — Buffalo — Chicago — Cleveland — Dallas — Denver — Houston — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington, D. C. — Wilkes-Barre — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va. — Salt Lake City

CROUSE-HINDS COMPANY OF CANADA, LTD., TORONTO, ONT.

**AIRPORT LIGHTING · FLOODLIGHTS**

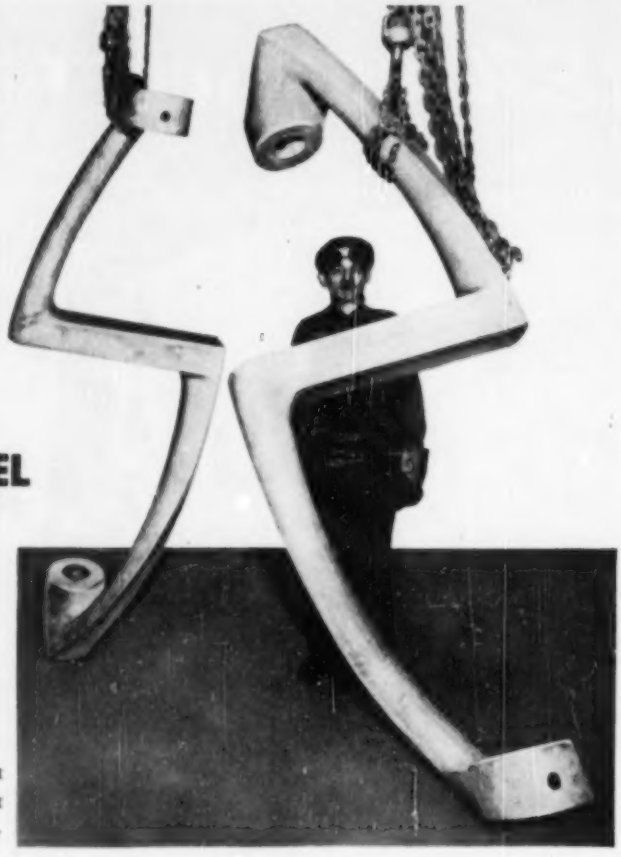
## Unique Cores Permit

# TEMPERATURE CONTROL OF BLADES

*cast in*

## CHROMIUM-NICKEL STAINLESS STEEL

*by Cooper Alloy Foundry*



MANY processers have discovered that the use of stainless alloys, for cast parts in contact with raw materials, provides the key to higher quality production. Moreover, appropriate types of cast stainless alloys permit improved designs, with correspondingly better operating results.

The agitator units shown above were cast in Cooper Alloy 17S, an austenitic chromium-nickel stainless steel corresponding in alloy content to AISI Type 304, or Alloy Casting Institute CF-8 designation.

Unusual specification requirements of these huge sigma-shaped blades constituted a challenge . . .

**THE PROBLEM:** Each casting, weighing one thousand, five hundred and fifty pounds, and measuring seven and one-half feet in length, required a one and one-half inch hollow core running full length . . . to provide a passage for water or steam with which to heat or cool the blade while in service.

Wide foundry experience indicated that because of the unusual shape of the blade sand cores would be unsatisfactory and very unlikely to withstand the pressures and metal temperatures during casting.

**THE SOLUTION:** In place of a sand core, the foundry selected stainless steel tubing of the same composition as the cast alloy. Realizing that heat generated by the poured molten alloy would melt and deform the tubing, Cooper engineers developed a procedure whereby water was continuously forced through this stainless tube while the casting was being poured. Thus, the temperature was held below the melting point of the tube, and a satisfactory cored hole was assured.

* * *

We invite consultation on the use of cast or wrought stainless alloys containing nickel. Send us details of your problems for our suggestions.

**THE INTERNATIONAL NICKEL COMPANY, INC.** 67 WALL STREET NEW YORK 5, N. Y.

# There's a Century MOTOR To Supply Dependable Power For All Popular Applications

Century motors are available in sizes from 1/8 to 450 horsepower, in a wide range of types and kinds — single phase and polyphase alternating current, and direct current. All of them are rugged built to assure top performance throughout a long service life.

## POLYPHASE

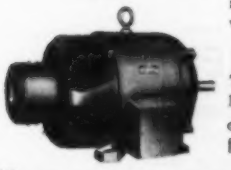
**Type SC—OPEN PROTECTED**—Form J, general purpose motor—meets the needs for most installations where operating conditions are relatively clean and dry. The top half of the motor frame is closed to keep out falling solids or dripping liquid.

**Type SC—SPLASH PROOF**—gives the necessary protection where plants must be washed down—keeps water out of the motor even when a hose is applied directly on the frame. Also provides protection against rain, snow, sleet and ice for outdoor installations.

**Type SC—TOTALLY ENCLOSED FAN COOLED**—protects against dusts, mist or fog detrimental to the vital parts of the motor. The inner frame protecting the motor is sealed to keep out harmful matter.

**Type SC—EXPLOSION PROOF** protects against atmospheres charged with explosive dusts or gases. They carry Underwriters' label for specific kinds of hazards.

**Type SR—SLIP RING**—wound rotor motors are suitable for applications requiring low starting current with high starting torque, reversing, or adjustable speed.



**Type SY—SYNCHRONOUS MOTORS**—suitable for continuous operation at a uniform load for power factor correction.

## SINGLE PHASE

**Type RS—REPULSION START INDUCTION**—single phase brush lifting motor suitable for applications requiring high starting torque with low starting current.

**Type CSH—CAPACITOR START INDUCTION**—single phase motor suitable when high starting torque with normal starting current is required.

**Type SP—SPLIT PHASE, INDUCTION**—single phase motors—suitable for light starting duty.

## DIRECT CURRENT

**Type DN—DIRECT CURRENT MOTORS**—suitable for use where direct current is available or its use desirable.

**These illustrations are typical of Century's complete line of motors. Others available include gear motors, generators, AC and DC motor generator sets.**

**Specify the right Century motor for all your electric power requirements.**

Popular types of standard ratings are generally available from factory and branch office stocks.

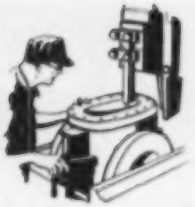
**CENTURY ELECTRIC COMPANY**

1806 Pine Street
St. Louis 3, Missouri

Century MOTORS

645

Offices and Stock Points in Principal Cities



**A DISTINCTIVE FEATURE IN DISC GUIDING**

Body guides are machined down to precision tolerances, assuring a perfect guide for the disc and creating a positive center line on which all subsequent machining operations are based.

**BODY PRECISION MACHINED TO INSURE PERFECT FIT OF SEAT RINGS**

This operation makes inserting the seat rings in a Lunkenheimer gate valve simply a matter of screwing them into position. Parts can be replaced without any machine work or special fitting.

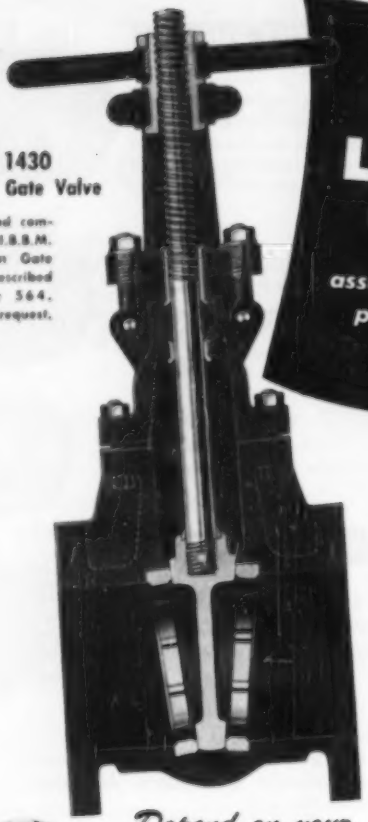


**Fig. 1430**
**Iron Body Gate Valve**

Fig. 1430 and complete line of I.B.B.M. and All Iron Gate Valves are described in Circular 564. Mailed upon request.

*Precision Made*
**LUNKENHEIMER VALVES . . . .**
*assure perfect-fitting, interchangeable parts . . . longer valve life . . . easier, lower-cost maintenance!*

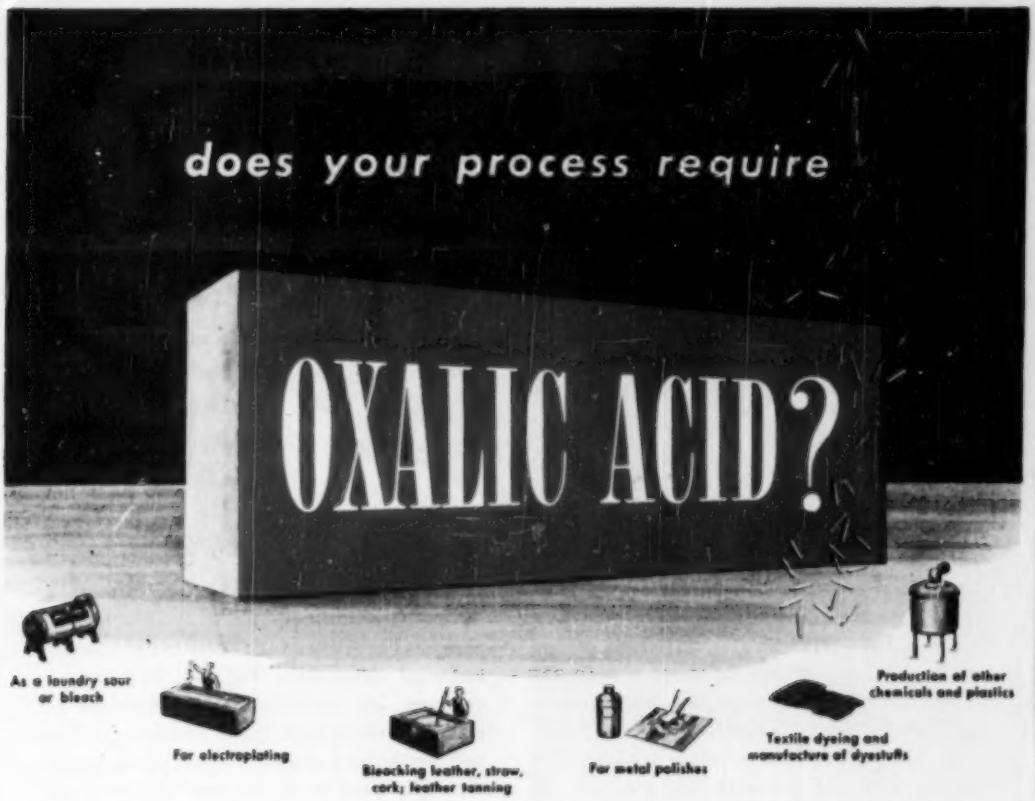
THE smooth working efficiency and low maintenance cost of Lunkenheimer Valves were not "made in a day." Behind this superior performance and economy lies long experience, top engineering and metallurgical facilities together with the most modern manufacturing equipment.

Lunkenheimer Valves have a streamlined simplicity of design . . . a minimum of working parts, each part of extra strength, correctly proportioned and perfectly balanced. This assures longer life with lower maintenance expense.

*Depend on your*
**LUNKENHEIMER DISTRIBUTOR**
*for service and reduced valve inventory!*

Many concerns, large and small, have found real savings by depending on the complete stocks of Lunkenheimer Distributors. Capital formerly tied up in slow-moving inventory is available for other uses; losses from obsolescence are eliminated or drastically reduced. Ask your Distributor how he can help you.

ESTABLISHED 1862
**THE LUNKENHEIMER CO.**
"QUALITY"
**CINCINNATI 14, OHIO, U.S.A.**
NEW YORK 13 • CHICAGO 6 • BOSTON 10 • PHILADELPHIA 34
EXPORT DEPT. CINCINNATI 14, OHIO, U.S.A.


does your process require
OXALIC ACID?
As a laundry sour or bleach
For electroplating
Bleaching leather, straw, cork; leather tanning
For metal polishes
Textile dyeing and manufacture of dyestuffs
Production of other chemicals and plastics

**GENERAL CHEMICAL—*the reliable, convenient source***

BASIC CHEMICALS

GC

FOR AMERICAN INDUSTRY

Wherever Oxalic Acid is used, General Chemical's product has long been preferred. First, for its purity and the uniformity of its crystal size. Second, for its ready availability from General's network of producing and distributing points in industrial centers from coast to coast.

This combination of consistent quality *plus* ready availability contributes much to the efficient and economical operations of many users. It can mean much to you too. For your needs . . . specify General Chemical Oxalic Acid, and be sure!

**GRADE:** Colorless needle crystals thru 10 mesh. Contains a minimum of 99.5% $C_2H_2O_4 \cdot 2H_2O$

**GENERAL CHEMICAL DIVISION**
ALLIED CHEMICAL & DYE CORPORATION
**40 Rector Street, New York 6, N. Y.**

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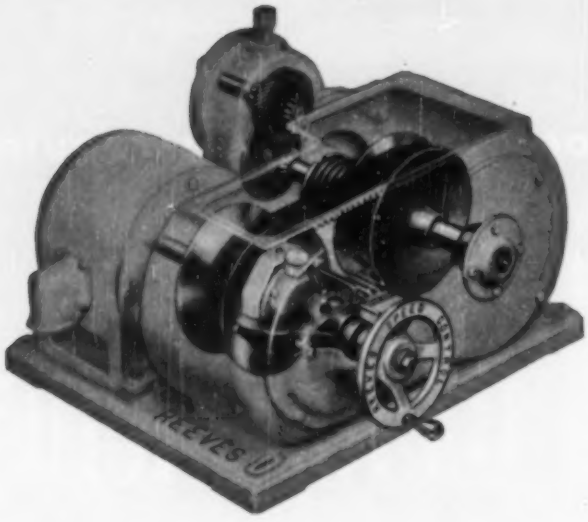



# CHAMPIONS – In the Field of Cost Reduction

In almost every industry, in thousands of factories and shops all over the world, certain machines are rendering championship service—performing unusually difficult jobs as if they were routine, and familiar every day jobs with greater ease and precision, because they are equipped with accurate, variable speed control —REEVES Speed Control.

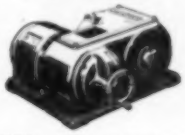
They are handling materials of widely varying consistency, weight, hardness and temperature . . . steel, textiles, rubber, foods, plastics, glass pharmaceuticals and many others. They are stamping, grinding, shaping, turning, winding, spreading, cooling, buffing, conveying and so on . . . some under the direction of skilled, experienced operators and others in the hands of awkward newcomers. But this they have in common: *all* 265,000 of these machines are equipped with REEVES Speed Control . . . *all* are performing each and every operation at exactly the right speed to get the best from man, material and machine . . . *all* are proving, through their day-after-day performance, that REEVES holds the key to improved production—cost-wise and quality-wise! They are proving that any good machine can be a champion—when equipped with REEVES Speed Control. Write for complete new catalog CE16-3N.

**REEVES PULLEY COMPANY • COLUMBUS, INDIANA**
*Recognized Leader in the Specialized Field of Speed Control Engineering*

THE THREE BASIC REEVES SPEED CONTROL UNITS

**VARIABLE SPEED TRANSMISSION** for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

**VARI-SPEED MOTOR PULLEY** provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 10 hp.



**MOTODRIVE** combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 20 hp.

*Accurate Variable*
**REEVES Speed Control**
*Gives the Right Speed for Every Job!*

F A M O U S

## *Caustic Comments*

When invited to attend a dinner party given by a snobbish socialite, the late John Barrymore replied in caustic tones, "I'm frightfully sorry I won't be able to come, Mrs. Bore. I have a previous engagement which I shall make just as soon as I possibly can!"

# Dow

*ONE OF MANY DOW CHEMICALS SERVING AMERICA*

**We have a *Caustic* Soda message also:**

**Dow is exceptionally well situated to supply industry with Caustic Soda in the Dow tradition of service, reliability and product-quality. Three Dow plants—in California, Texas and Michigan and bulk tank terminal distributing facilities at Carteret, New Jersey—are strategically located to serve your needs, wherever you may be.**

**"ORDER FROM DOW"**

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

**or telephone the nearest DOW branch office**

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| Atlanta | MAin 3085 | New York | PLaza 7-8300 |
| Boston | HUbbard 2-4890 | Philadelphia | Rittenhouse 6-2280 |
| Chicago | Financial 6-4221 | St. Louis | NEwstead 4977 |
| Cleveland | TOwer 1-5825 | San Francisco | GArfield 1-8323 |
| Detroit | TRinity 2-8186 | Seattle | SEneca 6488 |
| Houston | CHarter 3506 | Washington | REpublic 6608 |
| Los Angeles | TUcker 3181 | | |

The Dow Chemical of Canada, Limited, Toronto . . . . EGin 9208

DOW
CHEMICALS
INDISPENSABLE TO INDUSTRY AND AGRICULTURE

# For Your Information

## New Maleic Anhydride Briquettes Are Easier to Use . . . Safer to Use

If dust from maleic anhydride has been bothersome in your plant, or if you've found it troublesome to break up maleic anhydride that has solidified, you'll call Monsanto's newly-developed briquettes *good news*.

Monsanto's maleic anhydride briquettes are available now in commercial quantities . . . and at no increase in price over flake or fused forms. Compared with the product fused or in flakes, the new briquettes work to your advantage for the following reasons:

1. **They're *SAFER* . . . free of dust.**
2. **They're *EASIER* to weigh and handle.**
3. **They're *EFFICIENT* in application because they are uniform in size and shape.**
4. **They're *LOW IN MOISTURE PICKUP* . . . less hydrolysis.**

With these advantages . . . and with the price identical with that of other forms . . . the new briquettes already are finding wide acceptance among companies regularly using maleic anhydride.

For complete customer service, Monsanto is continuing to make maleic anhydride in flake and fused forms

If you would like more information, quotations and a sample of Monsanto Maleic Anhydride Briquettes, fill in and mail the coupon. Or, if you prefer, get in touch with the nearest Monsanto Sales Office.

## New Santolene C, in Gasoline and Oil, Stops Rust

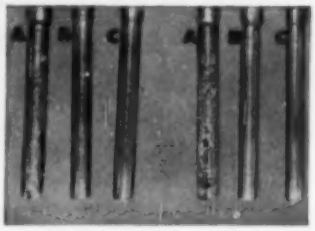


Illustration shows how Santolene, added to gasoline, stops rust. (A) Result with no Santolene C. (B) 10 ppm. Santolene. (C) 20 ppm. Santolene.

Santolene* C . . . developed through Monsanto Research . . . has solved the rust problem in transportation and storage of light petroleum products. Laboratory tests give evidence of the effectiveness of Santolene C. Pipe-line tests, now under way, are promising.

Santolene C is effective when used in small concentrations, hence it offers an economical way to end the rust problem. A 42-gallon barrel of gasoline or light oil can be inhibited for about 0.14 cents. At concentrations up to .01% Santolene has no noticeable effect on the usual specification items in gasoline, kerosene or No. 2 fuel oil.

If you'd like to put Santolene C through the paces in your own laboratory, mail the coupon for a free sample.

## Penta Protects Seats in Missouri U. Stadium

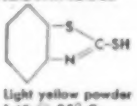
Seats in Memorial Stadium at the University of Missouri take a terrific beating from sun, rain, snow, sleet . . . and enthusiasm. So . . . when 5,000 seats were added to the stadium last season . . . officials decided to put long life into the wood. How? By using lumber treated with a water-repellent solution of Monsanto PENTAchlorophenol . . . to protect against fungi, wood-boring insects and weather. Penta, properly formulated and applied, gives a clean, dry treatment, free from objectionable chemical odor. The surface is paintable.

## Research Chemists' Corner

Chemists with creative imagination may see possibilities for new or improved products in Monsanto 2-Mercaptobenzothiazole. Look over the data on this chemical given below, and, if you are inspired to research, mail the coupon for a free sample.

**2-MERCAPTOBENZOTHIAZOLE**

**Structure:**




| | |
|---|---|
| **Appearance:** | **Light yellow powder** |
| **Specific gravity:** | **1.42 @ 25° C.** |
| **Moisture:** | **Not more than 1%** |
| **Ash:** | **Not more than 0.5%** |
| **Solubility:** | **Soluble in acetone, alcohol, benzene, chloroform and dilute caustic.** |

Two grades available, one assaying at least 97%, melting point at least 175° C., and another assaying at least 94%, melting point at least 170° C.

**Reactions**

Oxidation: Using peroxide, chlorine, persulfate or hypochlorite gives 2,2'dithio-bis-benzothiazole. Under strongly alkaline conditions the sulfonate is formed which on acidification yields 2-hydroxy benzothiazole.

Organic salts are formed by reaction with strong organic bases. Alkali metal salts are formed by reacting in aqueous medium. Heavy metal salts are formed by double decomposition of the alkali metal salts and soluble salts of heavy metals. Formaldehyde forms 2(hydroxy methyl mercapto)benzothiazole. Alkyl halides react to form alkyl thio ethers. Aroyl halides react to form thiol esters.

## Improved HB-40 Permits Bright Colors in Vinyls at Low Lost

Mon[illegible]o has improved HB-40 (partially hydrogenated terphenyl), making it practically water-white. Properly stabilized clear and tinted vinyl plastics, using HB-40 as an extender plasticizer, have good light stability.

HB-40 is an excellent low-cost plasticizer for polystyrene dispersions and casting resins.

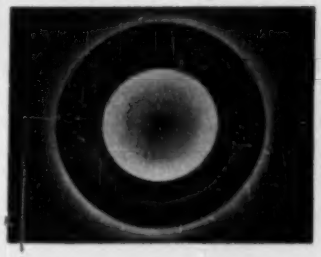
In vinyls, HB-40 is used as an extender for primary plasticizers, from 25% to 50% on the total weight of the plasticizer being used in many formulations. HB-40 is attractively low in price, making for economical production. It is extremely low in toxicity . . . strong in moisture resistance . . . has excellent electrical characteristics and is non-migratory, giving a dry "hand" and increased tensile strength.

HB-40 is used in vinyl extrusions; injection moldings; coatings for fabrics, metals and other materials; and in unsupported films. HB-40 is especially attractive for use in vinyl organosols and plastisols. It does not increase the viscosity of the pastes.

If you are interested in cutting costs, without sacrificing quality in your plastics, have a look at HB-40. Technical data, quotations and samples will be sent promptly upon request. The coupon is for your convenience.

**Vinyl film in which HB-40 served as an extender for the primary plasticizer**

## Methylene bis (paraphenylene isocyanate) Helps Make Rubber Stick to Fibers



New developments often bring new problems. That's what happened when synthetic fibers entered into the manufacturing processes of rubber products. Cotton had been used before.

The adhesives used to make rubber adhere to cotton would not work with the synthetics. Now, that difficulty has been overcome. Monsanto's Methylene bis (paraphenylene isocyanate) makes an adhesive that insures a lasting bond between rubber and synthetic fibers.

If you have need to bond rubber and synthetics . . . or if this application of Methylene bis (paraphenylene isocyanate) suggests other uses . . . get in touch with Monsanto. Sample and technical information will be sent upon request.

*Reg. U. S. Pat. Off.

## AROCLORS Put Extra Qualities in Paints for Maintenance Jobs

If you manufacture maintenance paints, you undoubtedly will be interested in AROCLORS (chlorinated biphenyl and chlorinated polyphenyls). They are used, as plasticizers or resins, by most leading makers of modified and synthetic rubber protective coatings for concrete, metal or wood.

The AROCLORS add qualities to protective coatings that *mean* protection. They give greater toughness and adhesion . . . stronger resistance to corrosion, flame, water and weather . . . greater resistance to acids and alkalies. They have good electrical insulating properties.

Manufacturers of protective coatings have a choice from a series of AROCLORS . . . both liquids and resins . . . having a wide variety of properties. If you are a user of paints, it will pay you to *specify* maintenance paints that contain AROCLOR.*

## Santophen 1 Tested in Germicidal Soap

Santophen* 1, introduced last year for use in disinfectants, has now found a new application—in coconut oil germicidal soap formulations. In tests, Santophen 1 retained its germ-killing power even when the soap-to-germicide ratio ran as high as 20 to 1. These tests indicate the usefulness of Santophen 1 in floor cleaners, rug shampoos, surgical soaps and industrial cleaners. (Word of caution: If you're thinking of using Santophen 1 in surgical soaps, you should test your formulation for irritation or dermatitis.) Further information and a sample of Santophen 1 will be sent to qualified persons upon request. Use the handy coupon.

## If You Must Dehair a Hog, Santomerse No. 1 Will Help

The task of scalding and dehairing hogs is made easier by the use of Santomerse* No. 1, a Monsanto Detergent and Wetting Agent.

Santomerse No. 1 lowers the surface tension of water . . . makes it wetter. It therefore penetrates the hog bristles and makes them easier to remove.

The detergent also helps to hold grease, waste, fat and blood particles in suspension so that they are not redeposited on the sides of the scalding vat.

The Santomerse No. 1 is added before the water is heated, at the rate of one cup of Santomerse No. 1 to 50 gallons of water.

MONSANTO CHEMICAL COMPANY, Desk A, 1702 South Second Street, St. Louis 4, District Sales Offices: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

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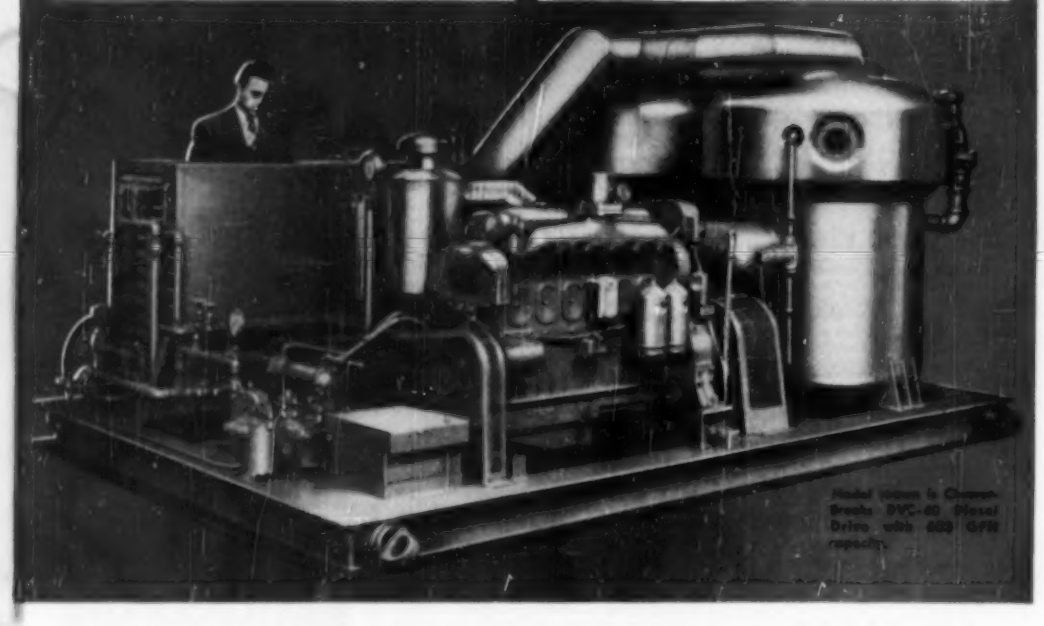
| | |
|---|---|
| Brine | Penicillin |

Other solutions and substances



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Cleaver-Brooks Compression Stills solve many concentration problems. They provide economical recovery of valuable solids which are normally lost in waste disposal. Cleaver-Brooks Stills have concentrated Tanning Liquors, Brine, Penicillin Slurry, Black Liquors from pulp mills and many other solutions.

Available in standard size units from 75 gph to 2100 gph, electric or Diesel drive. Larger sizes to fit specific applications can be constructed for field erection. Your water or concentration problem will be thoroughly studied by Cleaver-Brooks engineers and recommendations made for improving your plant production.

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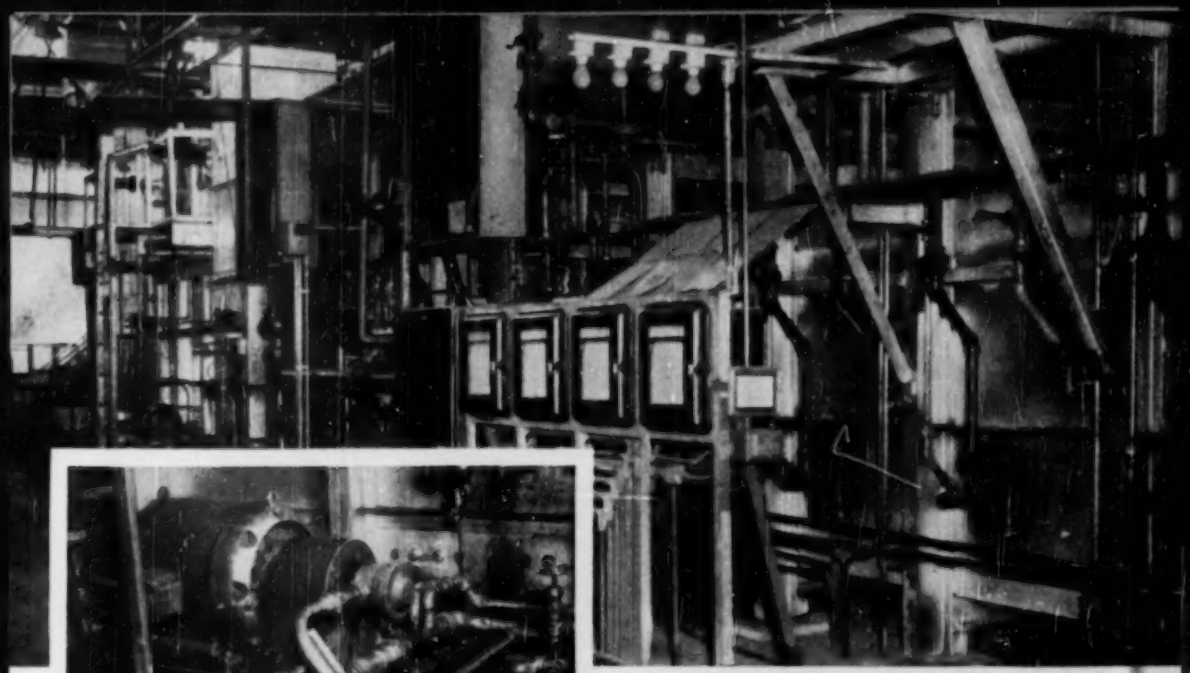

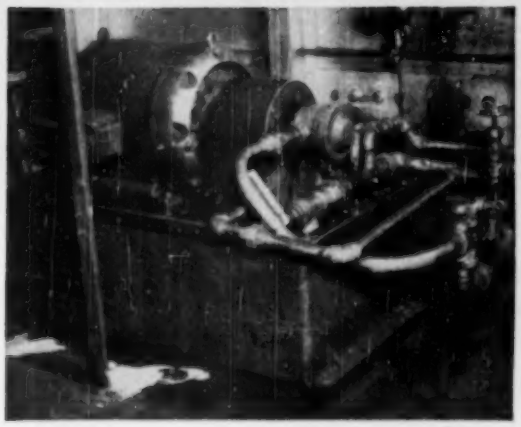

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# How to make your hydraulic operations more reliable

EQUIPMENT like that shown above is used for hardening automotive crankshafts in a midwest plant. Each unit consists of a hardening furnace and an automatic quench tank. Hydraulic units, operating through panel control boxes, move the crankshafts through the furnaces and tanks at prescribed depths and at fixed time cycles.

Because of manufacturing requirements, hydraulic units must operate continuously without shutdown for cleaning. At the same time, they must function perfectly to permit accurate control of furnace operations.

Stanoil 15 has enabled the hydraulic units to meet fully these two stringent demands. There have been no difficulties due to stuck valves. The hydraulic units have responded smoothly and promptly to controls. Oil systems have remained clean and free from deposits.

You can rely on Stanoils to give you the same clean, dependable operation of hydraulic units and of speed reducers and circulating systems as well. These unique, multi-purpose oils can replace many special and costly oils in your plant. A Standard Oil Lubrication Engineer will be glad to help you obtain the most economical use of Stanoil.

If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, to secure the services of the Engineer nearest you.

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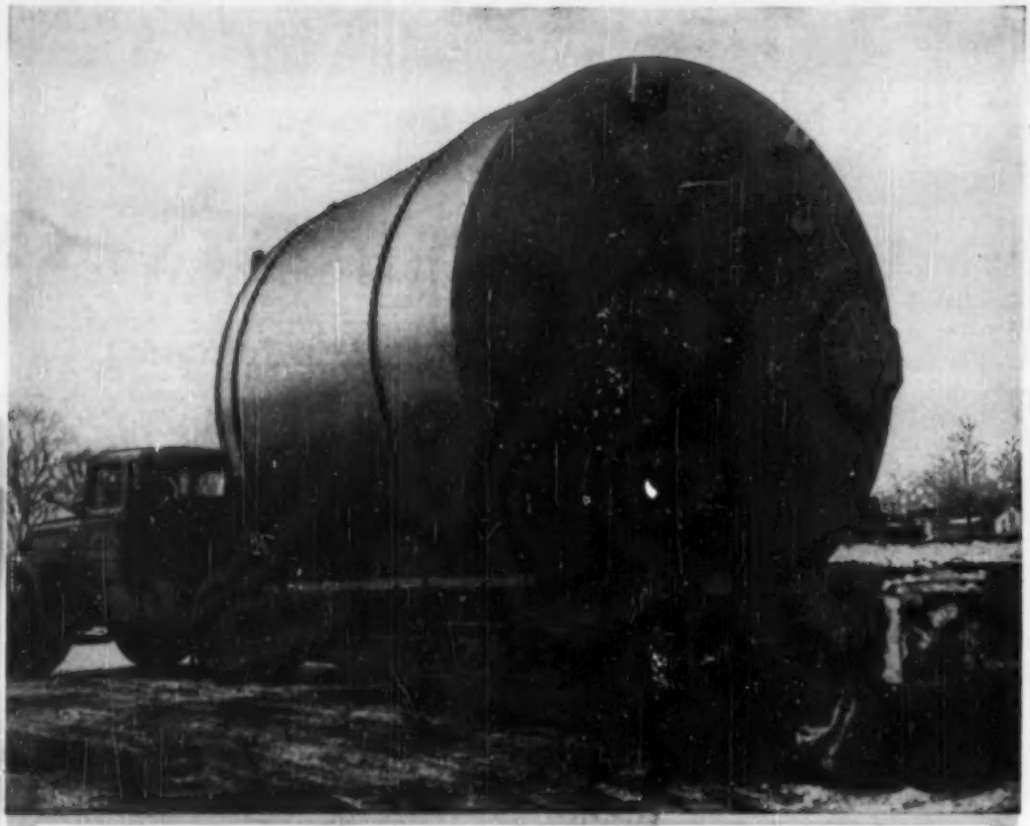

# What lining for greatest protection? Lowest cost?

On your next lined-tank installation — put it up to Stoneware. Send us your sketches or prints, tell us what solutions you plan to use, their concentration, what impurities are developed, operating temperatures and margin of safety required. In turn we'll suggest materials that will prove most effective, for the longest period of time, at the lowest cost.

"U. S." Engineers are not wedded to any one material. Whether we recommend our Tygon plastic sheeting linings, Tygoflex dip lining, Paraply rubber linings, USSCO acid Brick or Tile, Resilon asphaltic resinous linings, Republic sheet or homogeneously bonded lead linings, phenolic or Duralon hard coatings, the suggestion is made with one question in mind:

What tank lining will handle your solution the most effectively, for the longest time, at the lowest cost?

Back of our suggestions lies a broad working knowledge of all basic protective materials (gained by manufacturing most of them), plus a background of countless installations in virtually all divisions of the process industries.

What lining for greatest protection? Lowest cost? Put it up to Stoneware.

Are you using Tygon Plastic Paint to protect plant and equipment against corrosive fumes? Better try it. You'll save time, money and worry.

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## COMMENTS ON THE NEWS OF CHEMICAL ENGINEERING IN INDUSTRY

*Prepared under the editorial direction of Joseph A. O'Connor, News Editor*

**Copolymer hydrolyzed for easier dyeing**

Chemstrand, Inc., the new company formed by Monsanto and American Viscose, is going right ahead with plans for production of its new synthetic fiber.

It is said that the new fiber, called Chemstrand, is 85 percent acrylonitrile (see *Chementator*, Oct. 1949, p. 67). Now it is revealed that it is actually a copolymer of acrylonitrile and vinyl acetate.

After polymerization, the acrylonitrile-vinyl acetate copolymer is partially hydrolyzed to remove some of the acetate groups. This makes the fiber take dyes better. Normally, even modified acrylonitrile-polymer fibers are hard to dye.

**Titanium pigment plant for Ohio?**

New Jersey Zinc, shopping around for a plant site, has been paying more than passing attention to Ohio's Ashtabula-Painesville area. What New Jersey Zinc is going to do is put up a plant to reduce slag rich in titanium dioxide to the pigment and possibly later to the metal titanium.

Eventually, some 250,000 long tons a year of slag (containing as high as 80 percent $TiO_2$) will be coming from the fabulous $150 million Canadian mining and smelting project that New Jersey Zinc and Kennecott Copper have under way in Quebec.

The Ashtabula-Painesville area seems like a natural for this slag-reduction operation. The paint and steel industries are concentrated in that part of Ohio. The former is interested in titanium dioxide pigment; the latter, in the alloying possibilities of titanium metal. And it should not be hard to get enough sulphuric acid and even magnesium, if needed, in that center of chemical activity. Access to Canada by a water route is a vital factor.

**Bids on Schering this spring?**

Justice Department expects to put Schering Corp., big drug firm seized as alien property at the outset of World War II, up for sale this spring.

Acting Director Harold I. Baynton of the Office of Alien Property is hopeful that the government can by February name a date for submitting bids. Bid deadline will probably be set for late March.

OAP has received more than 250 inquiries from firms and groups eager to acquire this Bloomfield, N.J., pharmaceutical concern, whose sales topped $12 million in 1948. Schering's common stock has a book value of over $6 million. There is no preferred stock.

Justice Department attorneys are still untangling legal snarls over German hormone patents held by Schering. This has delayed the getting-out of a prospectus. Earlier, law suits by other claimants for the government-owned stock had been settled (see *Chementator*, Nov. 1949, p. 67).

**Du Pont offers to license patents**

Du Pont is listing another 730 of its patents on the U. S. Patent Office Register for licensing. This brings the total of patents Du Pont has registered close to 5,000. These are about three-quarters of the patents the company owns.

The patents cover plastic compositions, cellulosic materials, artificial thread, synthetic rubber-like materials, dyestuffs, adhesives and other products.

**Du Pont to own Kinetic outright**

Du Pont has concluded negotiations with General Motors for purchase of GM's interest in Kinetic Chemicals, Inc. Negotiations had been under way for almost a year.

Once the Securities & Exchange Commission gives Du Pont the green light, the deal will be consummated. Sale price agreed upon: about $9.7 million.

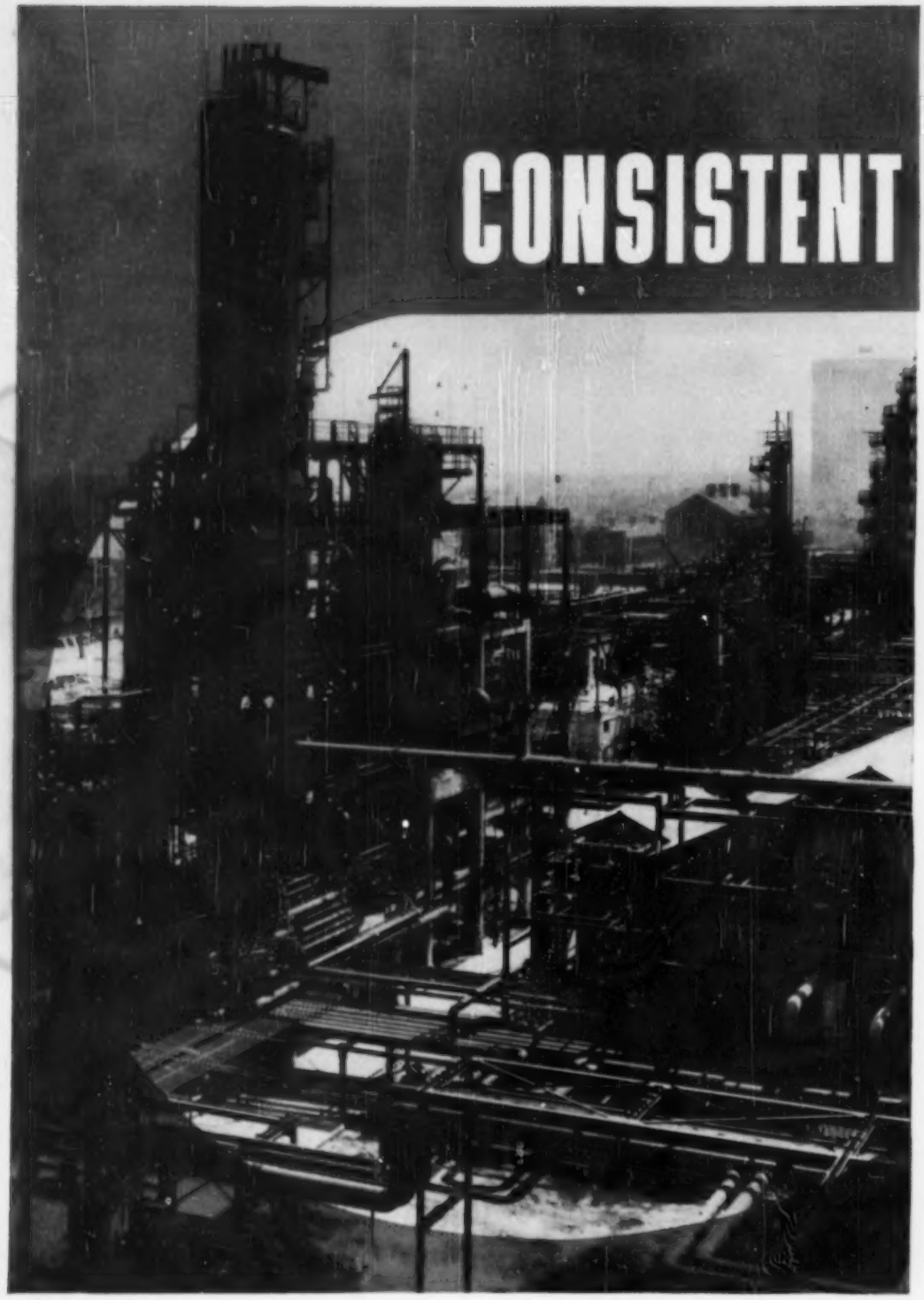
Kinetic Chemicals, founded in 1930 by Du Pont and GM jointly, makes the non-toxic and non-flammable Freon fluorinated-hydrocarbon refrigerants. Du Pont held 51 percent of the stock; General Motors, 49 percent.

First of Kinetic's manufacturing plants was built at Deepwater, N.J., within the Du Pont manufacturing area and in a position to utilize Du Pont facilities. Another plant was put into operation at East Chicago, Ill., in August 1944.

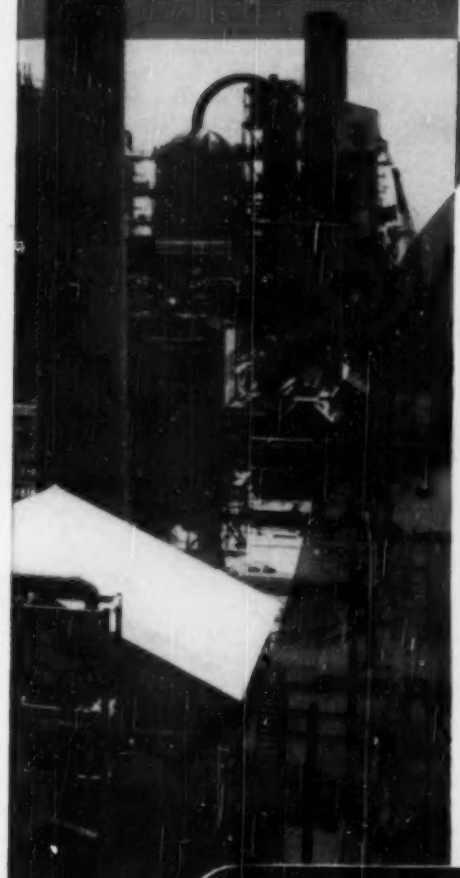
**Chemicals to power cross-country rocket?**

How would you like to cross the U.S. in less than an hour aboard a transcontinental rocket liner? Such a liner is within the grasp of present technology, thinks Dr. Hsue-Shen Tsien of California Institute

(*Continued*)


CONSISTENT

# PROGRESS in "The Heart of the Refinery"



This 32,000 barrel combination atmospheric-vacuum topping unit at Gulf Refining Company's Toledo, Ohio, refinery produces light and middle distillates as well as high quality catalytic cracking feed stock from sweet or sour crudes.

Wartime experience demonstrated the necessity for independent primary distillation facilities to maintain refinery balance when processing varying crudes. Hence this is the fourth two-stage unit which Badger has completed for Gulf's post-war program. All were engineered for wide flexibility in operation and with corrosion protection as determined by the economic balance between installation and maintenance costs.

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of Technology, outstanding authority on jet propulsion and rockets.

In a 3,000-mi. flight, the liner would follow an initial elliptical path for 1,200 mi., then glide for 1,800 mi. Altitude at the beginning of the glide would be 27 mi. Maximum velocity would be 9,140 mph., but landing speed would be only 150 mph.

Such a rocket vehicle would weigh 50 tons at launching, of which 37 tons would be fuel load. It would be 80 ft. long, and have a maximum diameter of 9 ft. The wings would not need to be large to achieve a reasonable landing speed.

As propellant, the rocket would use either a combination of liquid oxygen and liquid hydrogen, or of liquid fluorine and liquid hydrogen, Tsien predicts.

"One need not have any misgivings about high energy fuels and propellants for cooling difficulties," states Tsien. "Such strange combinations as liquid hydrogen and liquid fluorine, and diborane ($B_2H_6$) and liquid oxygen are to be considered.

"With either film cooling or sweat cooling, there is no limit to the temperature of the combustion gas that can be effectively handled." He explains that film cooling is achieved by establishing a thin liquid film in contact with the hot gas over the surface to be cooled. Sweat cooling, where the coolant is forced through the porous wall and injection and evaporation occur at the same time, is not limited to liquid coolants. The coolant may be gaseous.

The short operating time of a rocket unit presents tremendous possibilities in design not feasible in turbojet and gas turbine engineering, Tsien points out.

"By designing for minutes instead of for thousands of hours, as in the case of turbojets and gas turbines, we can use material stressed for ultimate strength, and not for creep. It can be stressed six times higher than material intended for long operating time."

Problems in materials, thermochemistry and chemical kinetics are being explored at the Guggenheim Jet Propulsion Center at California Institute of Technology.

**Tetroxide rockets into its own**

Long an orphan among chemicals, nitrogen tetroxide now promises to be adopted by the U.S. as one of the best bets among rocket fuels. Its high oxygen content (about 70 percent) makes nitrogen tetroxide a natural for use as an oxidizer in rockets, which must carry their own oxygen to burn other propellants such as gasoline or alcohol.

Should military and industrial demand for nitrogen tetroxide soar, the U.S. could turn out 500,000 tons a year by converting only 10 percent of total ammonia output to nitrogen tetroxide, estimates Solvay's Douglas H. Ross. It looks as though rocketing into the wild blue is going to pay off for nitrogen tetroxide in the long green (for full story, turn to p. 175).

**Alabama mill makes newsprint**

First wood pulp has been made at the new $32 million plant of the Coosa River Newsprint Co. Newsprint is just beginning to flow from the Childersburg, Ala., mill.

Actual production culminates a program sponsored by the Southern Newspaper Publishers Association. More than 125 newspapers throughout the country own stock in the big plant, which will be operated by the Kimberly-Clark Corp.

The mill, on lands leased from the government at the Childersburg Ordnance Works reservation, is designed to turn out 100,000 tons of newsprint annually at full capacity.

This is the first new source of U.S. newsprint to be developed in the past decade. It also is only the second in the entire South to produce commercial newsprint. The other southern plant is at Lufkin, Tex.

The mill will produce pulp from southern pine trees, and the pulp will in turn be converted into paper.

**For cotton linters, new possibilities**

If the economics of a new process developed at the University of Texas pan out, some novel uses can be expected for cotton linters.

The process, developed by Ralph Burdynski under Dr. K. A. Kobe's direction, works like this: first, cotton linters are cleaned, then de-waxed, finally transformed into alpha-cellulose. Cotton wax is an important byproduct.

"Our process is not practical from an industrial standpoint yet," says Kobe, who is associate director of the Industrial Chemistry Bureau at the university. "We are still in the talking and testing stage." Kobe has already conferred with Hercules officials in Wilmington, Del., and with others at Du Pont's Waynesboro, Va., plant about plans for getting into production.

**Dow sizing up Ashtabula site**

Dow has turned to the Ashtabula-Painesville district in Ohio as a possible site for the plant it had expected to build at Ironton along the Ohio River.

That site was ruled out when cities downstream protested that Dow's plans for dumping calcium chloride into the Ohio River would cost them thousands of dollars for water softening.

There would be no problem of stream pollu-

(*Continued*)

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tion along the shores of Lake Erie. And at Ashtabula Dow's plant would be sitting atop plenty of salt that could be brined and surfaced at little cost.

Dow will invest $15 million in construction of this plant. Best guess as to what the plant will make: ethylene dichloride and ethyl bromide for use as additives in tetraethyl lead.

**Carlsbad strike halts potash mining**

CRISIS—The strike of potash miners at Carlsbad, N.M., may lead to a crisis in the consuming industries this spring if the walkout continues through January. In the first month of the strike, production of more than 100,000 tons of high-grade potassium muriate has been lost. Normally, a total of about 4,000 tons of muriate a day is produced at Carlsbad, of which only 1 percent is inventoried.

COMPANIES—Close to 85 percent of the potash consumed in the U.S. is mined at Carlsbad by International Minerals & Chemical Corp., Potash Co. of America and United States Potash Co., the three struck companies.

ISSUE—Basic issue has been wages. This is despite the fact that the Carlsbad potash miners, with their average hourly wage of $2.05, are among the highest paid workers in industry. The companies, which bargain as a unit, offered last May to fix existing wages as minimum so long as the cost of living index was 170 or lower and to hike wages 1 c. an hr. for every point the index moved above 170.

STRIKE—The strike called November 19 by Local 415 of the International Union of Mine, Mill & Smelter Workers (CIO) signified rejection of the offer and a demand for a straight 25 c. an hr. increase, which the companies rejected. Of the 1,600 union members eligible, only 1,100 voted, and only 60 percent of these voted for the strike.

ACCEPTANCE—The escalator contract was accepted by potash refinery workers represented by the International Association of Machinists and the International Brotherhood of Electrical Workers (AFL). However, only U.S. Potash operates its refinery near Carlsbad as a separate unit and only this one continued in operation.

With the 35,000 tons of unrefined ore it had on hand at the start of the strike, U.S. Potash managed to keep its refinery, with its 500 workers, running. Even so, U.S. Potash operations were cut to half normal.

SKIRMISH—The 1,600 strikers were defeated in a skirmish with the Santa Fe. The railroad got an injunction to prevent the miners from lying down on the tracks to halt movement of potash cars on company spurs.

TOLL—While only 1,600 union members went on strike, a total of 2,000 men were put out of work. In addition, some 50 others, mostly the railroaders who normally move three or four trains of potash each day, were made idle.

Carlsbad, a community of 8,500, has been hard hit by the strike. Merchants have missed the $200,000 weekly payroll. Some potash workers, expecting a strike, began saving in midsummer. Business dwindled. Once the strike began, meat sales went down 75 percent; groceries, 50 percent.

The companies, too, are taking a shellacking. Lost production has cost them roughly $130,000 a day. Their combined annual output is estimated at $47 million when they operate a full 365 days.

TACTICIANS—The CIO Mine, Mill & Smelter Workers had much at stake in this strike. That is why its ace troubleshooters, William Gately and Howard Goddard, international representatives, were rushed in to direct the strike. (It was Goddard who masterminded the 111-day strike at American Potash & Chemical Co. in 1941.) And Maurice E. Travis, the international secretary-treasurer, who only turned in his Communist card so the union could comply with Taft-Hartley Act requirements, has been on the scene in Carlsbad.

SIGNIFICANCE—The union has attached national significance to this strike. It has sought an industry wage pattern that might even encompass the Trona, Calif., operations. More important, it has hoped to show President Philip Murray, who wants it kicked out of the CIO, its prestige and bargaining power by this strike. A left-wing union, already suspended for non-payment of dues, it is probably slated for expulsion from the CIO after a trial this month by a three-man CIO committee. Unless it pays its back dues, it will be unable to participate in the executive board meeting that decides its fate after the committee hearing.

SHORT-ENDERS—In this high-level union political maneuvering, the rank and file of potash miners have scant interest. Fed up with payless pay days, they would probably be glad to get back to work.

**New potash producers for Carlsbad?**

Are new companies going into the potash business at Carlsbad, N.M.? At least three are looking into the possibilities. These are the Southwest Potash Corp., a subsidiary of American Metal Co., the Duval Texas Sulphur Co. and the Freeport Sulphur Co.

All three have big acreages under lease in the Carlsbad area. Southwest Potash has carried out an extensive drilling program, but has not yet started ore development. Stearns-Rogers is already working up plant estimates for Duval, which is supposed to be going to use a flotation process.

Whether all of these companies are going to

(*Continued*)

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The FEinc exclusive String Discharge neatly handles cakes as thin as 1/16 in. with no limitation on thickness, ranging from "impossible" slimes to matty, fibrous cakes. It does away with scrapers, wire-winding, and blow-back, hence eliminates smearing, and gives clothes longer life.

Then there's the FEinc Compression Mechanism that removes 2-6% more moisture and reduces vacuum requirements. And the submergence type washing mechanism that washes cakes down to unbelievable purity. Other features that can be engineered to your needs at reasonable cost include drum-dryer combinations, scoring devices for feeding cake to continuous dryers, repuddling mechanisms.

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build plants is a moot question. Best bet to get into the potash business at Carlsbad is Duval.

It will be tough sledding for the newcomers, however. Potash Co. of America has recently stepped up its capacity; International Minerals & Chemical Corp. is increasing its output; and U.S. Potash has upped its capacity by about 25 percent. By this spring, the present producers will be turning out all the potash the market can absorb, barring an unforeseen increase in demand. The only other possibility would be for U.S. producers to export potash.

Meantime, due to ECA activities, the French mines are being modernized. And it seems likely that France, Germany and Russia may dump potash in the U.S. to get badly needed dollars.

**Colorado's stake in a pulp industry**

In the West, financiers and industrialists are eyeing with keen interest Colorado's proposed move into pulpwood production. Plans are afoot for pulp and paper mills along the Colorado River between Rifle and Glenwood Springs.

Preston Walker, president of Columbine Development Co., admits that his organization has been planning for more than a year to install a $17 million pulp and paper mill in the region. The mill would utilize millions of cords of dead timber from the forests of western Colorado—timber killed by beetles.

If Walker comes to terms with U.S. Forest Service officials in Washington, D.C., on a price, the purchase of the dead forest sections will be the biggest sale of timber ever negotiated by the U.S.

It will stake Colorado to a new industry with a payroll of more than $2 million a year. And Walker says the mill could operate for more than 30 years on the timber in the region.

U.S. Forest Service has long tried to sell investors on the idea of a pulp and paper industry in Colorado. But its efforts had been stymied first by the depression in the 30's and then by World War II.

A pulp industry would boost population in the mountain area by an estimated 8,000. It would mean a $150,000 annual expenditure increase by the company on roads in the forest areas. And the counties would get hundreds of thousands of dollars from the company over a 30-year period for timber cuts and forest fees.

**Sherwin-Williams drops farm chemicals**

Sherwin-Williams, one of the biggest insecticide manufacturers, is pulling up stakes, getting out of the agricultural chemicals business. At least two other major producers of DDT are likely to follow Sherwin-Williams out of the insecticide business.

The sudden decision to halt production came after a board meeting in the company's Cleveland, Ohio, headquarters. Earlier, Sherwin-Williams had closed its Yakima, Wash., laboratory, which had operated for 20 years. The move came as a surprise, since the company had been highly successful in the agricultural chemicals field, in which it had spent heavily for research.

From Oakland, Calif., where almost 7 million pounds a year of insecticides and weed killers had been turned out, and from Bound Brook, N.J., where Sherwin-Williams had its biggest pesticide plant, came the bulk of the company's output.

What will be done with these plants is not yet clear. However, representatives of chemical companies, among them Dow, Du Pont, Monsanto and General Chemical, have been inspecting the facilities at Oakland.

At Cleveland, Sherwin-Williams had recently completed a $275,000 agricultural-chemical research building.

What prompted Sherwin-Williams to pull out of agricultural chemicals? Surely it could not have been the threat that the agricultural chemicals division, despite its rapid growth since war's end, might someday overshadow the company's primary business of making paints. It is unlikely that the tail would ever have wagged the dog, for Sherwin-Williams' agricultural chemicals business was small compared to its paint business.

Had it been pared profits from insecticides and weed killers? Not on the West Coast at least, according to W. M. Choate, manager at Yakima. There, the business had turned in a higher profit in 1949 than in 1948. Perhaps over-all operations in agricultural chemicals, however, did not promise to pay off too handsomely.

Legal actions may have been a last straw forcing the decision. There had been a series of suits for contributory liability in damage incident to alleged improper use of weed killers. Total claims filed against the company are said to have come to about $1 million. And an Arkansas state supreme court decision, while it did not involve Sherwin-Williams, made the company think twice about the legal risks in the pesticide business. The Arkansas court held that any manufacturer failing to label containers with full and explicit directions and warnings about the risks in using his products is liable for damages caused by chance application (by airplane, for example) of chemicals on fields for which they were not intended.

But serious difficulties in marketing various insecticides and the near collapse of certain big DDT markets were probably more basically involved in the drastic decision reached by Sherwin-Williams.

—*End*

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# U.S.I. CHEMICAL NEWS

January ★ A Monthly Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1950

## *Nutrition Expert Gives Recent APF Developments*

Ingredients of animal and marine origin can be partially replaced by commercial APF supplements in animal feeds, stated Dr. H. R. Bird of the U. S. Department of Agriculture at a recent midwestern animal nutrition conference. Speaking conservatively he advised that high energy broiler rations should contain a minimum of 4% fish meal or 8% meat meal; starter or breeder mash may contain as low as 2% fish meal or 4% meat meal provided an APF supplement is used to furnish the rest of the essential APF complex. Dr. Bird mentioned that there is evidence of at least two additional factors, other than vitamin $B_{12}$, which go to make up the important animal protein factor.

Practical experiments with U.S.I. Animal Protein Factor Supplement have shown improved growth with this primary fermentation product as compared with $B_{12}$ concentrates mixed in the feed. There is evidence that along with guaranteed amounts of vitamin $B_{12}$, U.S.I.'s APF Supplement contains appreciable amounts of unidentified factors that are essential for optimum growth.

## Chemicals Used to Prevent Formation of Histamine

A new approach to the allergy problem is being taken in research with certain chemicals related to vitamin P—*d*-catechin and epicatechin. These chemicals help *prevent* histamine formation in the body, rather than interfering with its effects, as do the currently used antihistamines.

# Boating Enthusiasts Find Solox Ideal for Many Marine Uses

### U.S.I. Proprietary Alcohol Solvent Is Used for Fueling Yacht Stoves, Thinning and Removing Shellac, Cleaning Glass

Among yacht-owners and others who are mariners by avocation, U.S.I.'s proprietary alcohol solvent, Solox, has rapidly acquired a reputation for being an extremely versatile product for marine use. Solox burns with a clean, colorless flame, without odor, and leaves no residue. These properties, plus its convenient packaging – in easy-to-store, easy-to-pour gallon, quart, and pint containers, as well as the conventional 54 gallon and 5 gallon drums – make Solox tops for use as fuel in marine stoves.

Maintenance of protective coatings has always been a problem for the boat-owner. The superior solvent action and mild, non-residual

odor of Solox have made it a favorite for cutting and thinning spirit varnish and shellac, for softening undercoatings *before* sanding and revarnishing, and for cleaning and softening brushes.

Solox is also an effective general-purpose cleaner for use aboard ship. Used in combination with soap it dissolves difficult stains and removes most kinds of dirt and grease. A mixture of one-third Solox and two-thirds water rapidly softens dirt, fly specks, and oil spots on glass, leaving a clean, brilliant surface. Solox also removes dirt, oil, and water from metal surfaces and helps prevent corrosion.

**Many Applications in Other Fields**

Because of its general utility characteristics, Solox is also used in preference to completely denatured alcohol in a number of products and processes outside of the marine field. Lacquer manufacturers have found that 20 per cent Solox with 80 per cent toluol is

MORE

## Inexpensive Polio Vaccine May Come from New Method

A comparatively inexpensive process for producing a vaccine against poliomyelitis may result from a newly developed method of growing the virus on adult human tissue, in test-tubes. Previously the only known medium for culturing the virus in test-tubes was human embryonic tissue. With the new method it may prove possible to transplant the virus from the adult tissue to hens' eggs, as has been done in the past in cultivating other disease-causing viruses. Such a development might permit production of a polio vaccine in relatively large quantities.

## *How to Reduce Fire Hazard*

A new informative 12-page booklet, available now without charge, is designed to help industry reduce fire hazards and losses. The subject of flammable liquids particularly is covered in several sections of the booklet.

*Photo by Jack F. Laws*

**Air view of the Carthage Hydrocol, Inc., Stanolind Oil and Gas Company, and U.S.I. projects at Brownsville, Texas. On the right is the Carthage synthesis plant where natural gas will be converted to synthetic gasoline, other petroleum products, and crude chemicals. The chemicals will be recovered and refined in the Stanolind plant, center background, and then will be prepared for market by U.S.I., whose facilities are shown on the left. Early operation of the facilities pictured above is anticipated.**

## New Germicidal Powder Emits Its Own Light

Tests of a new medical powder, for use in both wet and dry dressings, have shown its unusual germicidal action. The new germicide, said to emit light in the ultraviolet range, was used on 22 cases of infected wounds, 20 of which had not responded to sulfa and other treatments. All the patients recovered. The powder is reported to contain chloramine T, potassium iodide, dextrose, and sodium biphosphate, and has a pH just over 7 in solution at room temperature.

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January ★ **U.S.I. CHEMICAL NEWS** ★ 1950

## *Plastic Bags Aid Mixing Of Ingredients That Stain*

A plastic-film bag which can be filled with a specified amount of an ingredient and then placed right in the mixing batch of certain types of products during their manufacture has been developed. The bag, which disintegrates in the mix, is designed for use with ingredients that cannot be handled without staining equipment.

## 'Urethan' without the 'e'

Urethan, an important ingredient in a number of pharmaceutical preparations and a raw material in the synthesis of many drugs and chemicals will be spelled without a final "e" in the *U. S. Pharmacopoeia XIV*. In making this announcement, the Committee of Revision added that the old spelling, "urethane," will be carried as a synonym to the title. U.S.I. is a major producer of Urethan, U.S.P.

CONTINUED

## *Solox For Marine Use*

one of the most powerful solvent combinations for ethyl cellulose. This mixture gives low viscosity solutions and superior final films. A mixture of Solox and ethylene dichloride is a popular solvent for cellulose acetatebutyrate lacquers, and Solox in combination with toluol may be used as a diluent to replace denatured alcohol in cellulose acetate lacquer formulations.

**Used in Chemical Manufacture**

Solox is employed in various chemical purifying and recrystallizing operations. Anhydrous Solox is often used as a reaction medium for chemical processes which will not go forward in the presence of water. Solox can also be used to furnish the ethyl group in chemical manufacturing processes where its denaturants are compatible with the other reactants.

Other applications for Solox include its use as an ingredient in airplane carbureter and propeller de-icing; for removing water and sludge from fuel oil tanks; for rinsing photographic negatives and prints, and cleaning ferrotype plates; and as an ingredient in the production of paint removers, liquid cements, polishes, and water-proofing materials.

## Ethyl Ether Helps Start Diesels in Cold Weather

Recent tests in this country, Britain, and Germany are claimed to have demonstrated that the use of ethyl ether as a priming agent is the most effective and potentially the most convenient method of starting diesel engines in cold weather. Diesel engine cold starting is said not to respond significantly to improvements in fuel cetane numbers, regardless of

the use of ignition accelerators. Although starting accessories like glow plugs and jacket heaters may be satisfactory for some applications, they are sometimes unreliable, inconvenient, and expensive.

## New Chemical Process For Polishing Metals

Metal products can now be given a bright, reflective surface without the need of mechanical or electrical operations, it is reported. In the new process the product is merely dipped into a chemical solution and when withdrawn a few minutes later is described as having a high, mirror-like luster. Chief advantage claimed for the new process in production is its simplicity — it may eliminate from one to four or five production steps in the finishing of a metallic product. Metals that can be polished successfully by the new process are said to include brass, copper, Monel, nickel, and aluminum.

## TECHNICAL DEVELOPMENTS

***Further information regarding the manufacturers of these items may be obtained by writing U.S.I.***

**Fast, cold-removal of paint,** varnish, lacquer, synthetic enamel, and japan finishes, without chemical after-wash, is claimed possible with a new paint remover, described as fire- and explosion-resistant, harmless to fabrics and polished metals, and non-irritating to the hands. **(No. 329)**

**A new finishing treatment for polyethylene** fabrics pre-shrinks them to less than 2% residual shrinkage at temperatures up to 165°F., it is claimed. **(No. 330)**

**To speed up emptying of tank cars** and to permit many viscous materials to be handled in cars not fitted with steam coils, new immersion-type steam heaters are on the market. The heaters can be handled safely by one man, the makers state. **(No. 331)**

**A new flame-retardant chemical** for cotton and rayon does not change the appearance or feel of these materials, it is claimed. Durable to dry-cleaning, normal home laundering, and weathering, it reportedly reacts chemically with the fabric fibers rather than merely coating their surfaces. **(No. 332)**

**Rubbers with high resistance** to heat, oil, light, ozone, discoloration, and gas diffusion, and with better flexibility and elasticity under compression are said to be available. They are reported based on acrylic esters and, though saturated, to be vulcanizable. **(No. 333)**

**Cars or trucks stuck in snow, ice,** mud, or sand can be easily driven out of difficulty using a new inexpensive device, it is reported. The device is said to provide a non-slip tread that does not cut or otherwise damage tires. It can be stored conveniently in the car, the makers state. **(No. 334)**

**An oil nylon typing ribbon,** claimed to produce exceptionally sharp, clear impressions and to be extremely durable, is now on the market. **(No. 335)**

**A new low-cost adhesive for labeling** glass bottles and jars, described as resistant to temperature and humidity extremes, is said to do a good job on wet, stippled, or slightly greasy containers, to be fast-setting, and to have ability to run continuously without building up on labeling machines. **(No. 336)**

**A new, odorless, one coat flat oil paint** permits interior painting without opening windows for ventilation, comfortable occupation of rooms during and after painting, and increased application efficiency, according to the manufacturers. **(No. 337)**

**New "ductile" cast iron** that is not brittle but can be bent or twisted is reported available now for many and varied uses. It has several times greater strength than ordinary cast iron and greatly increased ductility and shock-resistance, the makers claim. **(No. 338)**


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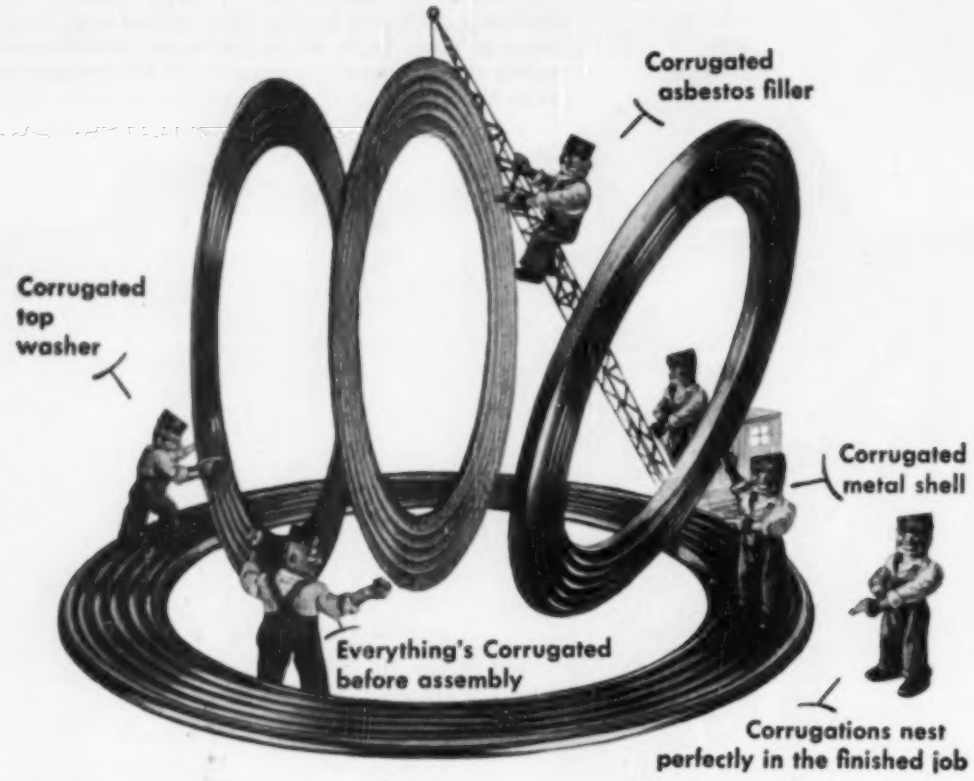
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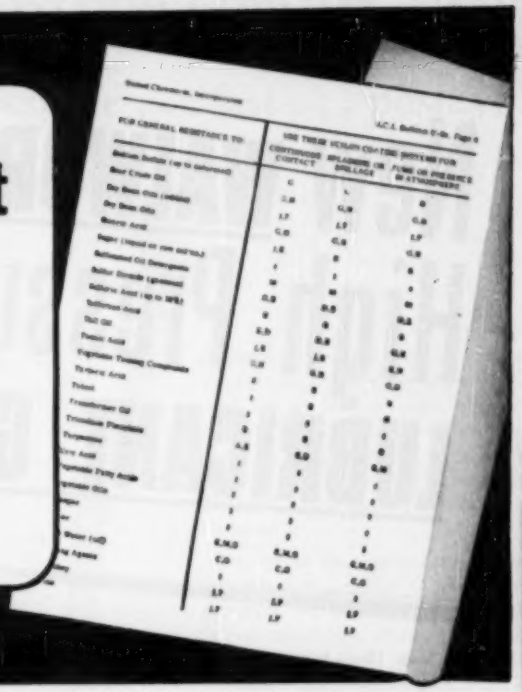

**Here's a systematic way to solve tough maintenance problems with UCILON* Protective Coatings**

You go straight to the core of your corrosion problem —and right to coatings that last longer, safeguard your equipment, and cost you less in the long run—when you use this booklet.

It's done simply. Over 150 common substances that cause paint failures and corrosion are listed — including acids, alkalies, salts, moisture, oils, organic compounds. You'll note that systems of Ucilon coatings are recommended for use in each case. By choosing the system that fits your own case, you automatically select those Ucilon coatings which again and again have *proved* they withstand direct contact with the corrosive, or spillage, or fumes. Step by step instructions then follow for applying the system.

Users in corrosion-plagued industries report getting outstanding protection and service from such Ucilon Coating Systems. Take the first step towards systematic corrosion control and reduced maintenance costs in your own plant — send for your copy of this booklet. See for yourself why Ucilon coatings have been successful so often where other coatings failed.

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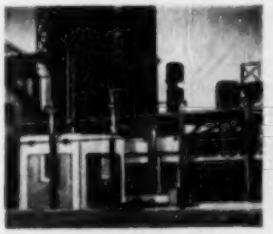

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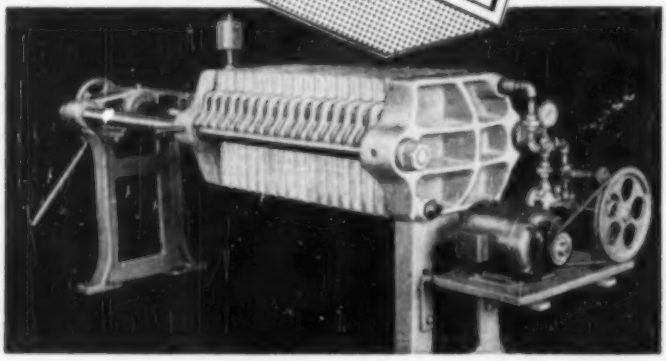

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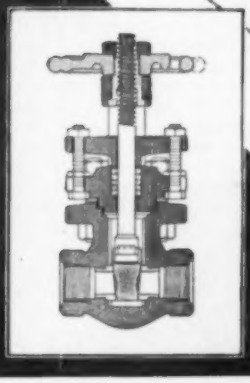

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# How Safety Was Delivered by Air!

It was late in the afternoon. BS&B Sales Engineer John Raidl was sitting at his desk, studying the SAFETY HEAD problem for a new chemical plant scheduled for construction. The telephone rang. Bayonne, New Jersey calling. An anxious voice, "Our new refinery is all ready to go. Except for one thing—we've got to have some special diaphragms for our SAFETY HEADS. The price isn't important. That plant must start operating the day after tomorrow! Can you send them by plane to arrive tomorrow night?"

Raidl jotted down the order. Two types of diaphragms were needed—three sizes—four different bursting pressures—lead lining or dipping on each diaphragm — all with vacuum supports tailored to fit. It was a tough order but he accepted it and immediately got in touch with R. S. Coffman, manager of the Diaphragm Department. He read him the order. "Great balls of fire!" roared Coffman, "They didn't miss a thing on that order, did they?" And they hadn't. "I can't do anything today — all the men have gone home—but we'll get rolling in the morning and you can consider the job done."

At five o'clock the next morning a workman lit the lead pots and the job was on its way. Two experts on material selection called "finders" got out their slide rules, made some rapid calculations, and selected four rolls of material from a stock that included the largest selection of thin ductile metals that is assembled in one place in the world. Allowance had to be made for the increase in bursting pressure that would result from lead lining and dipping. Samples were taken from each roll and inspected carefully for possible flaws. Two samples were dipped in the hot lead and the other two lined with thin lead sheet. Test diaphragms were made and burst to verify the bursting pressure estimated by the "finders." They were right on the money. Every sample proved out. Years of experience had given these men the know-how that could be obtained in no other way. A metallurgist from Quality Controls checked the materials to make sure they would do the job for which they were intended.

The green light was given to the fabricators. They cut material for the complete order, allowing for several extra diaphragms in each lot. On machines that were specially designed by BS&B, the diaphragms were formed and trimmed. Each one was put between flanges and tested up to 70% of its bursting pressure. They were checked for weak spots in the metal. None were found.

**Behind BS&B's ability to deliver the goods on this rush order was the groundwork laid by a trained metallurgist.**

The inspectors took over. They checked each diaphragm carefully. Two from each lot were burst. Every one burst within 5% of the pressure at which it was rated. One of the inspectors found a thin scratch on one of the lead-lined aluminum diaphragms and scrapped it. You can't take chances in this business. People's lives and millions of dollars worth of equipment are at stake. Three new diaphragms were made. Two were burst. The bursting pressure checked out.

It was almost noon and the vacuum supports still had to be made. Another call from Bayonne, New Jersey. "Will that order be here tonight?" Work on the vacuum supports began. Each one had to be hand-tailored to fit the diaphragm with which it would be installed. A vacuum support chart that had been prepared from years of experience was consulted and the thickness and type of metal selected. Vacuum supports and diaphragms had to fit perfectly. There could be no air space between them. Fabricators worked carefully and skillfully. The job was finally completed and each diaphragm and vacuum support given a final inspection. Every item was approved and tabbed.

The job was rushed to the shipping department where the shipping manifest had been waiting since early morning. Each diaphragm and vacuum support was carefully packed to prevent possible scratching or denting. At 4:05 p.m. a special truck picked up the coveted package and whisked off to the airport eight miles away.

Threading his way through the heavy afternoon traffic, the driver finally screeched to a halt at the airport just as the plane taxied out to be loaded. He picked up his precious cargo, dashed into the airport office, and handed it over with the shipping manifests to a waiting clerk. As the plane roared down the runway for the takeoff with the package aboard, the driver stepped over to the telegraph office and wired the flight number to Bayonne, New Jersey.

That night an anxious group of engineers met the plane at the airport. They picked up the package and rushed off to their new refinery. A quick but careful installation of the SAFETY HEADS was made. The pipe line opened up. A new refinery was in operation. BS&B had come through!

All orders for SAFETY HEADS are not filled as dramatically as this but they all get the same careful attention. If you have a pressure vessel protection problem in your plant, SAFETY HEADS may be your answer. Write today for complete details! Black, Sivalls & Bryson, Inc., Section SH-5, Special Products Division, Power and Light Bldg., Kansas City, Missouri.

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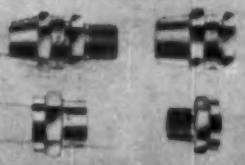

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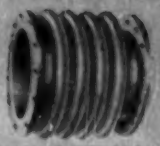

Expansion Joints for high and low pressures—stainless steel and copper.

Bellows in all sizes for all requirements—stainless steel and brass.

Flexible Conduits in a variety of types and materials.

Flexon identifies CMH products which have served industry for more than 47 years.

Now you can secure all your flexible metal hose needs from a single manufacturer. The handy check list above indicates only the more common types and assemblies manufactured by CMH. Other types and assemblies are also available. Bulletin 102, illustrated at the left, an application guide for CMH Flexible Metal Hose is available on request. Other literature giving full details on expansion joints, bellows and speciality items is also available. Write for your copies of the material in which you are interested and have it available for reference at all times.

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You specify the conditions under which the valve must operate. Usually your Powell distributor will know which is the right Powell Valve to meet them. If the conditions present a problem he can always consult Powell Engineers, or if you prefer, write to us direct.

At all events be sure you install the *right* valves—it's easy to do with the Powell Line.® Failure to do so will mean faulty performance instead of the long, trouble-free operation you can expect from the right Powell Valves.

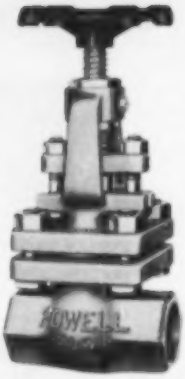


**Fig. 1978-NI**—150-pound Nickel Globe Valve with screwed ends, bolted flanged yoke-bonnet and outside screw stem. 4-bolted flanged bonnet Angle and Gate Valves in this design are also available.

**Fig. 1793**—Large 125-pound Iron Body Bronze Mounted Gate Valve. Made in sizes 2" to 30", inclusive. Has outside screw rising stem, bolted flanged yoke and tapered solid wedge. Also available in All Iron for process lines.

**Fig. 2081**—150-pound Stainless Steel "Y" Valve with flanged ends, bolted flanged yoke and outside screw rising stem. →

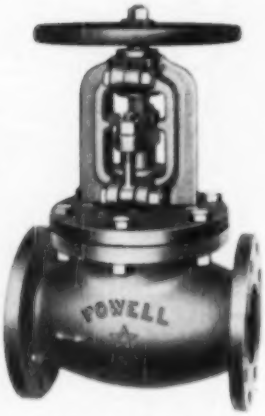


**Fig. 2429**—150-pound Stainless Steel Globe Valve with flanged ends, bolted flanged yoke and outside screw stem.

# POWELL

# We'll *supply* the RIGHT valve

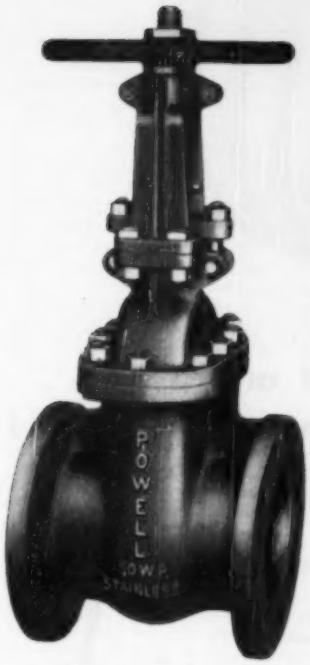


Fig. 2483-G — Large 150-pound Stainless Steel Gate Valve with bolted flanged yoke-bonnet, outside screw rising stem and tapered solid wedge. Available in sizes 5" to 30", inclusive.

Fig. 1708 — 200-pound Bronze Globe Valve with screwed ends, union bonnet, renewable heat treated stainless steel seat and regrindable, renewable, wear-resisting "Powell-ium" nickel-bronze disc.

Fig. 375—200-pound Bronze Gate Valve. Screwed ends, union bonnet, inside screw rising stem and renewable "Powellium" wear-resisting nickel-bronze disc.

Fig. 1843 — 200-pound Monel Metal Swing Check Valve with screwed ends and screwed-in cap.

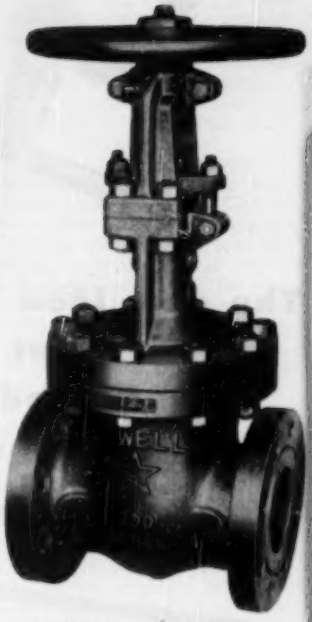


Fig. 3003—Class 300-pound Cast Steel Gate Valve with flanged ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.

***The Complete Powell Line includes Globe, Angle, Gate, Check, Relief and Flush Bottom Tank Valves in Bronze, Iron, Steel and a wide range of Corrosion-Resisting metals and alloys.**

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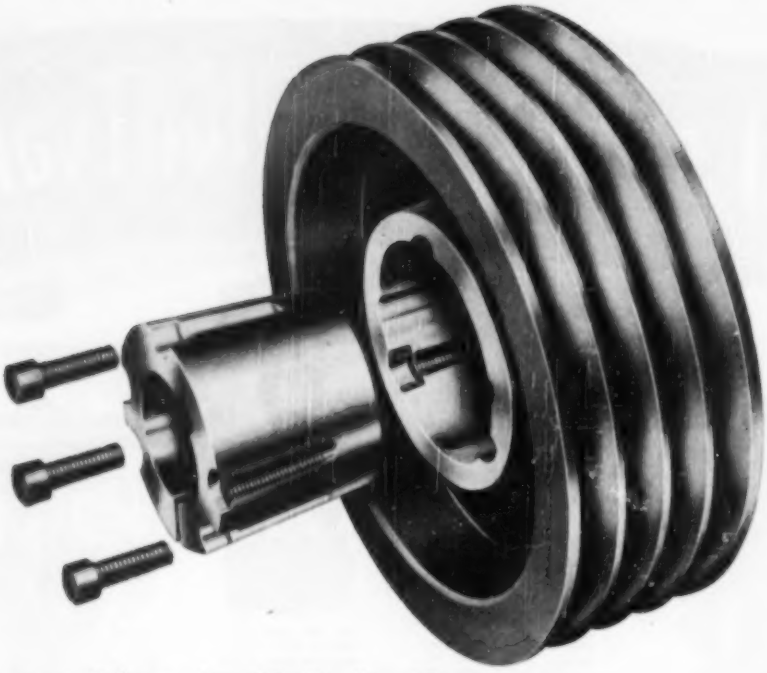
# VALVES



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# Memo from the Editors

## Dear Reader:

Here is your first sample of "Memo"—something new in the pages of *Chemical Engineering*. It will be an unpretentious one-pager that will show up every month, same location. For a while it will be experimental, just as any new department in any publication is — or should be — experimental. If you like it, we'll keep it up; otherwise, out it goes.

• **The Whys**–Every new editor soon finds out that an editor's life is an exciting one (otherwise he's in the wrong job). Sure, it's sprinkled with deadlines and punctuated by emergencies. But most of all it is full of the fun and satisfaction that come from working with people, authors, type, printers, ideas, imagination, processes and plants, theory and practice–all rolled into one. And that's exactly why we started "Memo": to pass along to you some of the interesting little things we bump into while serving as your editors.

• **The Whos**–Just so you will know whom of us to praise or blame, here are the ones largely responsible. The suggestion to start it was put forth by Roger Williams and Joe O'Connor. Joe and Ed Fetter won a prize for thinking up the most acceptable title; their "Memo" was picked from a list of 69. (Among the rejects: "Fact, Froth and Fancy" and "Editors' Scuttlebut"). Ed Fetter and Lois Stamey worked up the layout. John Callaham will write and edit the page for the time being. Ideas for the items come from all of us, sometimes from authors, friends, readers and correspondents.

## Letter from Los Angeles

Every day we get close to a dozen letters from readers, friends and others who ask for our advice on some problem, big or little. We enjoy helping out, but sometimes we are stumped. Here, for example, is the alpha and omega of a letter that somehow found its way to us:

"McGraw Hill Washington News Bureau Los Angeles Calif. Miscellaneous Metals and Gasses

Sirs I have a fine deposit of high Grade Flurospar where labor compells me to turn it all to Acid so I would appreciate all data be given me at earliest possible time M assay returns are 99.8 and C is .55 so give All details at once please"

No name, no initials, no address. We can't even let Mr. X know that we sympathize.

## 78,000 Miles

Travel agencies have good reason to cater to editors. Last year, for example, the 12 editors of *Chemical Engineering* chalked up 78,000 miles of on-the-job, out-of-town travelling in the United States. Purpose: to prepare articles, pick up trends, gather news, give talks, attend meetings and —most important—to find out what you engineers in industry have on your minds. Sid Kirkpatrick took first place with over 25,000 miles; he visited some 25 major cities in 15 states. Roger Williams rolled up over 10,000 miles in 18 trips to 14 cities.

That reminds us how one publisher has been more-than-hinting that all us "old-line editors" just sit in an ivory tower selecting "long, drawn-out, heavy, difficult-to-read dissertations" and mumbling: "We really ARE good. Whatever we say readers should read, *must* be read." Some ivory tower that can circle the earth 3.1 times in one year!

## From Idea to Article

How long does it take to develop an idea into an article? Anywhere from a couple of months to several years. This issue's article on perlite popping by Clarion Taylor took five years. Here's the story.

Since early 1945, John Callaham had been scouting for somebody who could *and would* write an article on perlite—not on the geology, mining, or uses in construction materials, but on the processing and engineering details. In 1948 he took a trip to Denver. But the plane that flew John in flew his luggage and briefcase right back out. That made it pretty tough to do anything that evening. In desperation, he decided to go to a movie. On the way he noticed a natural resources exhibit, dropped in, bumped into Clarion Taylor, chief chemist and director of research for AleXitE Engineering. Mention of the word perlite, then the talk of the West, set Clarion off; for six years he had spent his days learning how to pop the stuff, his nights dreaming about it. John, sensing that Clarion was his man, wrangled a promise from him.

But there's always a lot of work between promise and print. There followed the usual correspondence, outline, first draft, boil-down, second draft, correcting, editing, approving—and so on. The industry changed so fast that Clarion had a bring-up-to-date job every time we sent a revision for approval (he revised the table of producers four times). And R. P. Rains of AleXitE's public relations once sighed: "Clarion's penmanship—while of unmatched syle—is singularly undecipherable . . . ." (True of almost every good author).

Now, after 15 months of this typical promise-to-print jockeying, we take real satisfaction in publishing Clarion Taylor's article on the processing of perlite. You will find it on page 90. It justifies, we believe, all our efforts of over a year—and it's *still* the first published article of its kind on this new industry. If it doesn't answer all your questions about perlite, ask Clarion for a copy of the 75 percent we couldn't publish for lack of space.

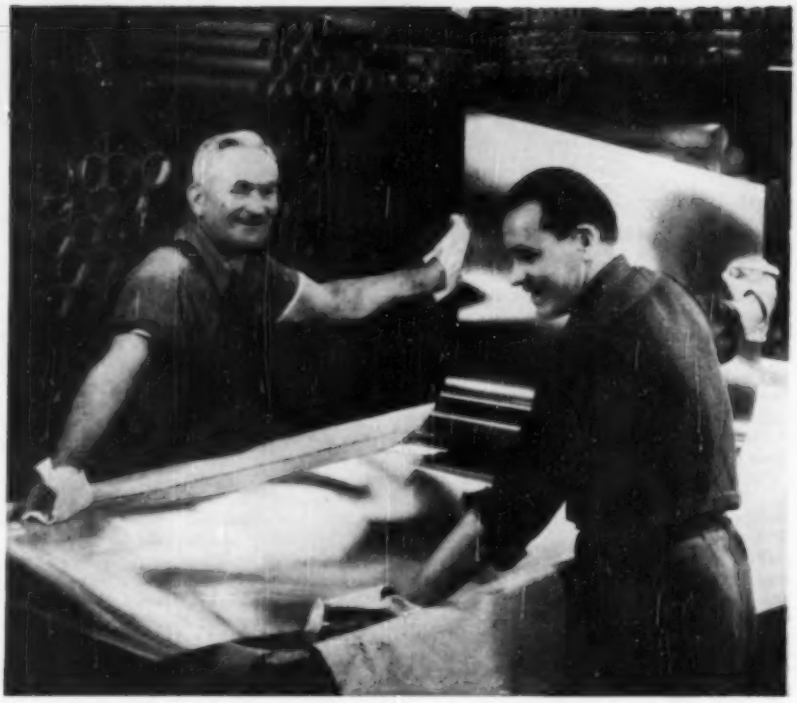
## Bits and Pieces

• Diamond Alkali's R. E. Hulme recently prepared an article on the thermodynamic properties of chlorine. It gave a lot of data that engineers have needed for decades; naturally we were proud of it. But the printers (for reasons known only to printers) changed the contents page to read "sulphated chlorine." Les Pope patiently corrected it to "superheated." But by the time you got your November issue, the printer had changed it back to "sulphated." Les is still hearing about "his error."

• Well, are pressure vessel walls too thick? Whether you believe so or not, Ben Miller's provocative article on p. 94 should set you thinking. It did us.

• There's a lot of talk going around now about the relative value of "permanent vs. working literature." Our N factor report in this issue, we believe, belongs to both breeds of cat. In other words, we'll bet our boots it will be "fingered as well as filed." That's why we're publishing it.

• Coming in an early issue of "Memo": How an engineer would rewrite Shakespeare.



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# RYERSON STEEL

ESTABLISHED 1902 SIDNEY D. KIRKPATRICK, Editor

Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

JANUARY 1950

# Younger Blood in Executive Veins

Never in the memory of most of us have there been so many opportunities for technical men in top-level jobs in the process industries. The prime need is for leaders who can guide and coordinate the forces of science and industry. Companies have become so complex that successful executives can no longer be picked from the ranks of other industries. That is why more and more of our companies are looking for potential executives in their own backyards.

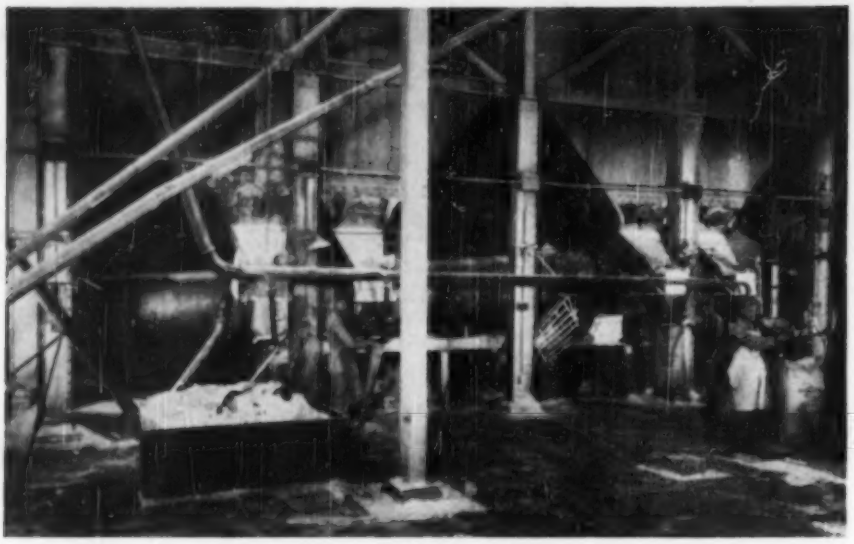
Unfortunately, however, in this era of intensive specialization, it is difficult to find men who are proficient in their own fields and at the same time well grounded in the broader phases of business activities. This difficulty in finding leaders is further complicated by the fact that technical men are often slow to see their own blind spots. They fail to recognize the fact that human and economic aspects of industry are becoming more and more important. They sometimes pass up opportunities for training and experience that would fit them for executive responsibilities.

This problem of finding new leaders has become so acute that some companies have started to do something about it. Standard of New Jersey is one that is no longer willing to depend on "the crisis method of executive selection." At the last API meeting in Chicago, George Corless described Esso's methods of organization and training for executive development. Special committees are set up in every department or subsidiary to screen employees and push the most promising into positions where they will gain broader experience and education. Sometimes fairly important jobs are created just to give these candidates the practical, first-hand knowledge they will need as future bosses. Rotational training is also used because, according to Mr. Corless, "it broadens the employee's knowledge of his company's operations in a minimum of time."

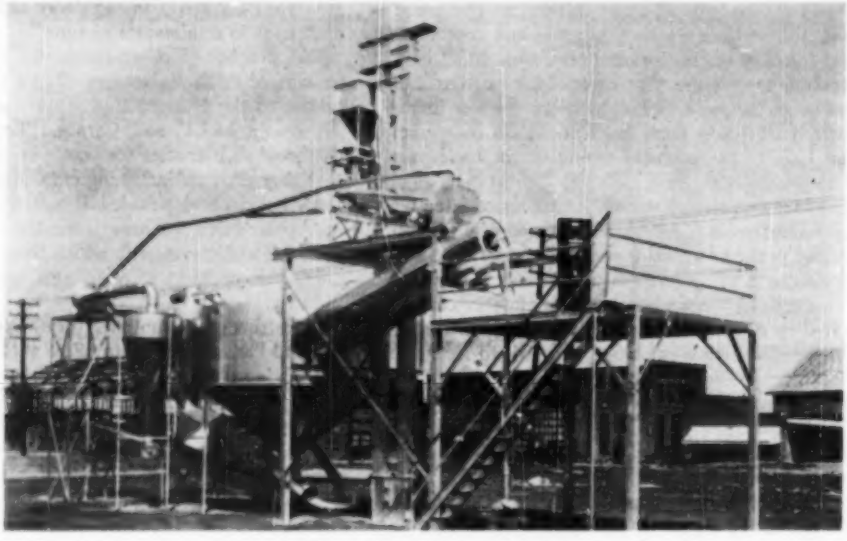
A number of other companies are taking advantage of extension courses offered by such institutions as the Harvard Business School, Wharton, Pittsburgh, M.I.T. and Carnegie Tech. Those in charge of such courses for young executives tell us that they draw an increasing enrollment from both the chemical and petroleum industries. From our own observation we have noted the enhanced enthusiasm and energy with which these postgraduate alumni have tackled their new assignments in industry.

Just before his untimely death last spring, Dr. Willard Dow had put into effect a unique program for moving younger men into positions of executive responsibility. He visualized a corps of junior executives who would have real responsibility for running the company while the senior officers sat by to advise, guide and coordinate. The pattern was well established and many of the changes accomplished before Dr. Dow's death. Consequently the transition of over-all responsibilities was apparently effected with a minimum of difficulty and delay.

Not all of us, to be sure, are fitted for administrative work. There is still need for many more specialists than generalists in the process industries. But for the one in ten—or a hundred—who is equipped for top leadership, there are almost unlimited opportunities. And we can all benefit by making certain that the younger technical men in our companies are given the proper incentive for growth and development.



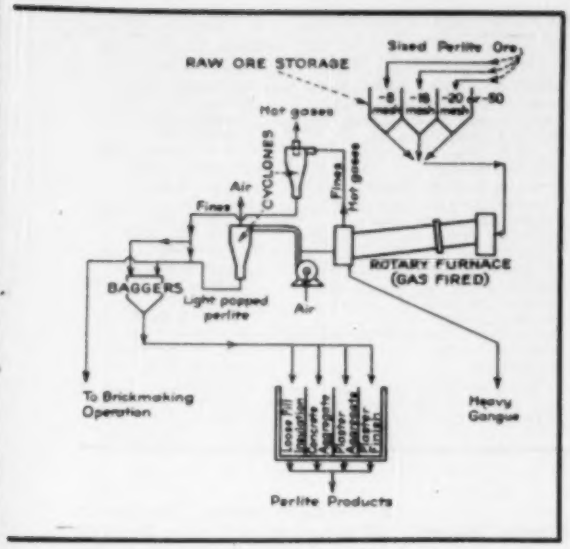
A typical perlite expansion furnace (AleXitE). Water of hydration explodes a ton of ore to fill 200 cu. ft. AleXitE



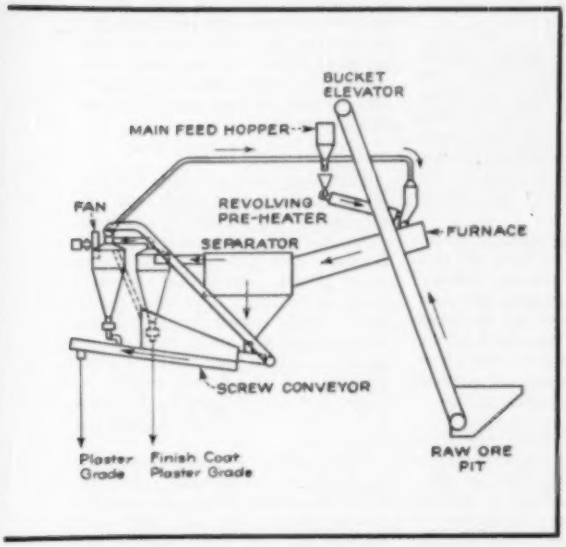
Another of the many types of expansion furnace (Muehleisen). "Best" furnace is matter of dispute, may depend

# Perlite Popping: From a Shaky Start, a

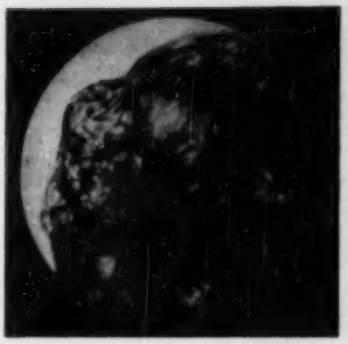
**For a swaddling industry, it has had some man-sized difficulties to overcome: a little known raw material, a tricky furnacing operation, a lack of basic engineering data.**




process is shown diagrammatically in drawing above.




on character of ore, which changes from place to place.

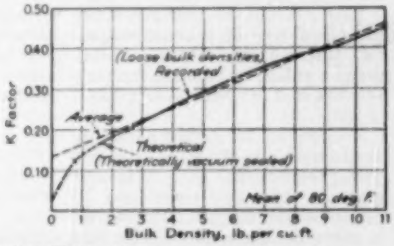


**PRODUCT.** Siliceous bubbles explain lightness and insulating properties. (125X)

| | Per Ton of Charge |
|---|---|
| Raw Material: | |
| Cost at Texas Creek, Colo.. | $7.60 |
| Freight to Ft. Worth, Tex.. | 7.98 |
| Cost of unloading..... | 0.51 |
| Labor. | |
| Furnace operators ..... | 2.50 |
| Sacking and storing..... | 1.70 |
| Utilities: | |
| Gas (6,000 cu.ft. at $0.14).. | 0.84 |
| Electricity ..... | 0.85 |
| Operating Overhead ..... | 3.32 |
| Bags (2-ply, 4 cu.ft.)..... | 6.00 |
| Total cost, bagged ..... | $30.70 |
| Cost per cu.ft. of product, bagged ..... | $0.134 |
| Average selling price per cu.ft. | 0.262 |
| Average profit per cu.ft..... | 0.128 |

Supplied by W. C. Maxey of Texas Perlite Corp., Fort Worth, Tex. Production data: Ore charge (No. 2 PerAleX), 0.5 ton per hr. or 264 tons per month. Production, 115 cu.ft. per hr. or 60,720 cu.ft. per month. Yield, 230 cu.ft. of 5-lb. plaster aggregate per ton of heads. Operating labor, 2 men per shift to operate, bag and store. Operating basis, 66 8-hr. shifts, 22 working days per month.

**PRODUCTION COSTS** may vary widely; in this example, freight is major item.




**K-FACTOR.** Heat transfer coefficient of one AleXitE product is close to theoretical.

# Solid New Industry

**One of the first comprehensive articles on the subject, by a pioneer in the field, appears here on the next three pages . . .**

## These Firms Pop Perlite

| | |
|---|---|
| AleXitE Engineering Div., Alexander Film Co. | Colorado Springs, Colo. |
| Carolina Perlite Co. | Salisbury, N. C. |
| Cleveland Gypsum Co. | Cleveland, Ohio |
| Combined Metals Reduction Co. | Salt Lake City, Utah |
| L. D. Germain | Montreal, Que. |
| Great Lakes Carbon Corp. | Linden, N. J. |
| Great Lakes Carbon Corp. | Los Angeles, Calif. |
| Grenz Lumber Co. | Grand Rapids, Mich. |
| Hutchinson PerAleX Co. | Hutchinson, Kan. |
| Johnston Manufacturing Co. | Minneapolis, Minn. |
| Lake Zurich Cement Products | Lake Zurich, Ill. |
| J. P. Loomis Coal & Supply | Akron, Ohio |
| Masco Perlite, Inc. | Houston, Tex. |
| Midwestern Perlite Corp. | Dalhart, Tex. |
| Midwestern Perlite Corp. | Oklahoma City, Okla. |
| National Perlite Co. | Campbell, Calif. |
| Ozark-Mahoning Co. | Tulsa, Okla. |
| Page Converter Co. | El Monte, Calif. |
| Panacalite Perlite, Inc. | Kansas City, Kan. |
| PerAleX of New Jersey, Inc. | Paterson, N. J. |
| Perlite Div., Dant & Russell, Inc. | St. Helens, Ore. |
| Perlite Corp. of America | Chula Vista, Calif. |
| Perlite Industries of Arizona, Inc. | Phoenix, Ariz. |
| Perlite Manufacturing Co. | Carnegie, Pa. |
| Perlite Products Co. | San Francisco, Calif. |
| Perolite Products | Sausalito, Calif. |
| Persolite Products, Inc. | Denver, Colo. |
| Persolite Products, Inc. | Joliet, Ill. |
| Precast Slab & Tile Co. | St. Louis, Mo. |
| Rushmore Perlite Co. | Rapid City, S. D. |
| Ryolex Corp. | Tucon, Ariz. |
| H. Schabo & Son | Appleton, Wis. |
| Silbrico, Corp. | Chicago, Ill. |
| Sno-Lite Products Co. | Reno, Nev. |
| Standard Perlite Co. | Pasadena, Calif. |
| Swann Perlite Vibrating Furnace Co. | Birmingham, Ala. |
| Texas Perlite Co. | Fort Worth, Tex. |
| Trilite Corp. | Houston, Tex. |
| United States Gypsum Co. | Chicago, Ill. |
| UTCO Products Co. | Salt Lake City, Utah |
| Western Perlite Co. | Phoenix, Ariz. |

# An industry with no producers in 1940 now boasts more than 40 scattered from coast to coast. This is the record of their tribulations and successes.

CLARION W. TAYLOR

Perlite processing was non-existent in 1940; today it is an industry that has attracted over 100 active or potential manufacturers. The product, known as popped perlite, is a lightweight material that can be put to many uses. Heat and sound insulating properties in particular qualify it for use in plaster, light-load bearing concretes, and prefabricated masonry units. It is also used as a filler in plastics and resins and in filtration.

Source of this new material is perlite ore—a type of siliceous volcanic rock that, when crushed and heated, shows a puffing or popping characteristic like that of cereals such as wheat or rice.

This puffing of crushed perlite ore is attributable to the water contained within the solidified rock. This water content, which may range from 2-5 percent of the weight of the ore, determines two principal variables: heat and heating time. These are controlled to yield a product of approximately 10 times the volume of the raw ore.

First commercial attempt in this country to make use of the unusual puffing characteristic of perlite rock was evidently made about 1940 by L. L. Boyer of Superior, Ariz. Development of the industry took place in the western states where the most extensive deposits of rock were found. As new uses for processed perlite were developed, the industry began to expand into the central and eastern states.

Perlite processing consists of two main operations: (1) mining and milling the ore, (2) furnacing, followed by classifying and bagging the product. Perhaps the best way to discuss the process is to describe first the plant and equipment of one manufacturer, then to point out some of the deviations in equipment design.

### HOW ONE FIRM PROCESSES PERLITE

Processing equipment used by the AleXitE Engineering Div. of Alexander Film Co. consists of (1) mining, crushing and screening equipment at the mine near Rosita, Colo., and (2) a rotary furnace, classifying and bagging equipment at the plant in Colorado Springs, Colo. Subsidiary equipment is used for making perlite-filled concrete brick. The chief perlite products are: loose-fill insulation, concrete and plaster aggregates, plaster finish, and glazed and unglazed brick.

The mining of perlite ore is essentially an open pit operation; it is stockpiled until needed. The ore first goes to the primary crusher. Then it is dried if necessary. The dryer is an oil-fired rotary. From the dryer it is conveyed to a secondary grinder and screens. In making plaster aggregate, the + 16 mesh is returned to the grinding circuit, the −50 being stockpiled for other uses. In making concrete aggregate, the +8 is returned to the grinding circuit; again the fines are stockpiled. Various size screens are used to control the percentage of intermediate ore sizes needed for particular uses.

### FURNACING: THE KEY STEP

Furnacing, the key operation in perlite processing, is divided into two principal steps: preheating and popping. AleXitE uses a selective preheat process. This preheating takes place in an integral zone within the main popping furnace. The fines, being more rapidly moved by air currents and more quickly heated, enter the expansion chamber ahead of the coarser particles. This selective preheat arrangement was designed by Engineer Jack Green of AleXitE engineering department.

Temperatures in the preheat zone are kept between 800 and 1,000 deg. F. It takes 166,000 Btu. to preheat a ton of characteristic ore. After preheating, the ore passes directly into the popping zone of the furnace. Here temperatures are kept between 1,850 and 1,950 deg. F. (depending on the size of the ore feed) for "John-Clare" PerAleX ore. Other ores pop at different temperatures. In the popping zone, some 1,000,000 Btu. are used per ton of characteristic ore with a bulk density of 68 to 84 lb. per cu. ft. The ore expands into a product of 7-15 lb. per cu. ft.

The AleXitE Junior furnace used

*Clarion W. Taylor is director of research and chief chemist for the AleXitE Engineering Division of Alexander Film Co, Colorado Springs, Colo. His chief job—to learn more about perlite and how to pop it.*

in this operation is a low-cost, cast-iron, rotating cylinder built to withstand temperatures up to 2,200 deg. F. A refractory lining protects the furnace cylinder and reduces heat loss. This unit, which one man can operate, is cradled on a slope of 1 ft. in 8. It has a length of about 16 ft.

Perlite ore, crushed so as to produce the desired type of product, is fed directly into a furnace hopper. The ore is withdrawn from this hopper by a screw conveyor or Syntron feeder; it is fed to the furnace at the rate of 0.25 tons per hr. Inside the furnace the flow of ore and heat are con-current. The preheat zone is maintained away from the furnace inlet by directing a natural gas flame down the cylinder from the feed end. The rotary motion of the furnace conveys the ore to the discharge end in 4-5 min. It is withdrawn at a capacity rate of about 50 cu. ft. per hr.

AleXitE also has a larger furnace that operates on the same principle as the Junior type. It has an output of about 2,000 cu. ft. of perlite per shift. Head feed is 1.15 tons per hr.

Two cyclone separators collect the expanded perlite. The normal furnace product, propelled by an auxiliary blower, is collected in one separator; the entrained fines from exhaust gases are caught in the second one. Perlite is fed selectively from the separators into a bagging bin or to a brick manufacturing unit. Molded brick and bagged product are then stored.

Although early furnace designers overlooked the advantage of preheating the ore, experience proved it had definite value. Murdock and Stein[1] pointed out that preheating not only heats the large particles nearly to popping temperatures but also reduces the combined water content of the ore; this relieves breakage from thermal shock when the particles are heated to softness in the popping zone. Some types of furnaces preheat in a separate chamber.

### THE MUEHLEISEN FURNACE

One such preheat design is the unit developed by Herman Muehleisen (see cut). This consists of a small rotating preheater and a separate stationary furnace 21 ft. long and 32 in. in diameter. The preheater, which is above the furnace, and the furnace are both slightly inclined in opposite directions so that the low end of the preheater is adjacent to the high end of the furnace.

A bucket elevator carries the sized ore from a pit at ground level to a feed hopper above the preheater inlet. Ore is drawn from the hopper by a Syntron feeder and forced to the preheater at a rate of 0.5 tons per hr. Once inside the preheater, the rotary motion of the vessel carries it forward to the discharge. Since the burner is located at the inlet end, the flow of ore and heat are con-current. The ore drops from the preheater discharge into the furnace at the hottest point of the burner flame. Here, lightened by the expansion of popping, it is swept along through the furnace with the flame and the exhaust gases by a downstream exhaust fan. Processed perlite is thus carried from the furnace at a rate of 100 cu. ft. per hr.

Product from the Muehleisen furnace passes directly into an air separator. Here the heavier material settles; the very fine particles, pulled by an exhaust fan, pass to and settle in a dust collector. Light material is drawn from the collector and bagged for finish-coat plaster. As the heavier material is removed at the base of the separator, additional fines are exhausted to a second dust collector; the heavier product is carried by screw conveyor directly to a bagging chamber.

Features of the Muehleisen unit are its simple, economic operation and its compactness. The stationary design of the furnace eliminates the moving parts and resultant higher upkeep cost of the rotary type. Automatic equipment gives close temperature control within a range of 1,000 and 2,400 deg. F. and the water vapor driven from the ore in the preheater is removed at the preheater discharge end. The entire Muehleisen operation requires only two operators. The 32 ft. high unit is so compact that it can be erected within a ground area of only 15 x 56 ft.

### OTHER FURNACE TYPES

Another perlite furnace that is meeting with industrial approval is one developed by John B. Murdock and Herbert Stein. This furnace, which is of the rotary type, is part of a unit that also uses a rotary preheater. Contrary to the Muehleisen principle, the Murdock-Stein preheater is larger than the furnace. The unit uses a counter-current flow of heat and ore; it is noted for its clever air blast arrangement at the preheater inlet that eliminates fine particles of ore before they enter the system.

Many other furnace designs are in use or under development. Most of these incorporate horizontal or vertical design coupled with stationary or rotating principles of operation. One type uses a vibrating hearth; another, a revolving hearth; and still another, a movable belt. Experimental designs offer much promise for improving the poor furnace efficiency of many units in use today.

Although fuel costs are low, furnace heat efficiency is also low. This is shown by the 30 percent efficiency quoted for the AleXitE furnace—which is considered high in the industry. Competition among perlite processors will make it imperative that operating efficiencies be improved. Yet it should be kept in mind that, in areas of low-cost natural gas, fuel cost may actually be less than 5 percent of the total manufacturing cost.

### FURNACE FOULING

The big problem with most perlite furnaces is that of fouling or plugging—which happens when expanded perlite sticks to the furnace lining. This is particularly noticeable with large con-current rotary type furnaces that have refractory brick linings. Its probable cause is the expansion of fine particles ahead of, and at a lower temperature than, coarse particles. When expanded fines from the low-temperature zone of the furnace reach a section where temperatures are high enough to expand larger particles, the fines melt, stick to the wall and build a crust. If not removed, the crust will thicken enough to materially cut down output.

There are various ways to combat or control furnace fouling. When furnace design does not solve the problem, furnaces must be shut down and the crust removed. This can sometimes be done by cooling the furnace quickly enough to fracture the solid crust; in other cases it becomes necessary to break loose the crust with a metal bar. On the other hand, fouling is relieved by (1) using stainless steel furnaces that can withstand high temperatures without permitting fusion of the product or (2) removing fine material (the source of the trouble) from the ore feed. Fines can be removed in several ways: (1) by using the Murdock-Stein unit already mentioned; (2) by varying the milling procedure by wet grinding; (3) by using the improved dry-grinding screening process recently put in at the AleXitE mines.

The wet grinding technique outlined by F. D. Gustafson[3] consists of first crushing the rock and then wet grinding in a rod mill at 35 percent bulk density. Removal of ground ore as soon as it is down to proper size prevents overgrinding. This is done by sludging the material over a vibrating screen in an excess of water. Material retained on the screen is pumped back for regrinding; that passing through goes to a hydroseparator where residual fines are separated from acceptable ore. This wet grinding process uses about 15 tons of water per ton of milled perlite. With a cheap

water supply, however, it is an excellent way to remove excess fines from the ore.

### RESEARCH AND DEVELOPMENT

Many research findings and their development show the real achievements of a new industry that is recovering from early promotionalism and the lack of basic knowledge and technical information.

One such achievement is the success of AleXitE in making an extremely lightweight perlite product (0.78 lb. per cu. ft.), possibly one of the lightest granular inorganic materials ever made. It has a particle size range of 590-840 microns, and consists of ovaloids containing almost perfect vacuums. It is about five times lighter than some of the better insulating materials in accepted use today. Theoretically, it has a thermal conductivity factor below the value for still air, but conductivity tests have not yet been completed. It is still a laboratory curiosity and is not yet in production. The commercial development of this type of material is one of the many new possibilities in the perlite industry.

This material could conceivably become a nearly ideal insulating filler: it has light weight, chemical inertness, and complete resistance to fire and rot. If used, for example, as an insulating filler for a refrigerator, a unit with 7 cu. ft. capacity could be enlarged to 10 cu. ft. without increasing the outside dimensions of the box and with little increase in radiation surface.

**Chemical Analysis of Rhyolitic Perlite***

| | Percent |
|---|---|
| $SiO_2$ | 69.79 |
| $Al_2O_3$ | 14.72 |
| $Fe_2O_3$ | 2.07 |
| MgO | 1.08 |
| CaO | 1.49 |
| $Na_2O$ | 2.75 |
| $K_2O$ | 2.98 |
| $H_2O$ | 4.00 |
| Cl | Trace |
| $SO_3$ | Trace |
| $MnO_2$ | Trace |
| Total | 99.88 |

* Ore sample from John-Clare mine of AleXitE Engineering Division of Alexander Film Co., located near Rosita, Colo.

To offset such developments, however, research has had only spotty success in unravelling the actual chemistry of perlite processing. Much work is now being done to correlate the expanding temperatures of perlites and other glasses with their chemical analyses. The only correlation that seems to have been corroborated is this: the more basic glasses at their softening points cannot retain the bubbles of expanded gas. Thus, an acceptable ore (see table) must have an $SiO_2$ content approaching 70 percent with low percentages of the oxides of calcium, magnesium and iron. The fusion or popping point of perlite may be related to the sodium and potassium oxide content of the ores. The part played by alumium oxide is still not known. Manganese oxide appears to be responsible for the unusual whiteness of expanded PerAleX.

### RESEARCH OF FURNACE OPERATION

Research has tried to tie in successful furnace operation with the use of an oxidizing or reducing flame. Studies of furnace operation under both vacuum and pressure continue but much remains to be learned. So far, the chief factors that affect furnace operation seem to be (1) temperature, (2) heating time, (3) the size, (4) water content of the ore and (5) the chemical or molecular structure of the ore. Either the chemical analysis (table) or the molecular structure must be responsible for the great strength-to-weight ratio and the lack of excess fines (due to decrepitation) of AleXitE's John-Clare ore. These unusual qualities of this ore appear consistently regardless of the type of furnace used.

In studying temperatures and heating time, we have in general found that the longer the retention time required for expansion, the stronger the product. This is possibly due to surface bubbles that insulate the inside of the particle, thus requiring a longer heat treatment. As a corollary, reducing the particle size would cut down furnace retention time.

When flash popped, perlite that has been properly preheated intumesces quickly, but usually decrepitates and produces excess fines.

King, Todd, and Kelley[3] investigated the influence of the water content of perlite ore on its processing. They concluded: (1) that water above 1.2 percent is loosely held and therefore easily removable; (2) that only water below this amount, possibly that below 0.5 percent, is important in perlite expansion. The conclusions of these investigators may or may not be applicable to all types of perlite. It appears that their studies were made on onion-type perlite. Granular, onion-skin, lithoidal and pumiceous types may result from different chemical analyses reflected in different molecular structures, or they may be different in molecular structure although the ore analyses are identical.

Work at our research department along this line, while still in an embryonic stage, may have far-reaching effects by pointing out the types of ore best suited for producing strong aggregates. Preliminary tests indicate that removing too much water from a lithoidal or pumiceous type perlite results in a non-poppable ore; under identical moisture removal temperatures (1,000 deg. F.), the onion-skin variety is still expandable. The true black obsidian is also poppable as well as the fine granular.

Here, then, appears to be a necessary research project to determine (1) how much heat should be used in the preheater for different types of perlite, (2) if approximately 1 percent or less of the combined water is what actually does the popping, (3) at exactly what point should the unnecessary water be removed without removing the slight amount of water that is believed to be necessary for expansion. Furthermore, if the tightly held water as well as the other plus-water may be eliminated in say, lithoidal-type perlite at a comparatively low figure, then it may be in order to re-calculate the Btu.'s necessary for popping.

### VARIETIES OF PERLITE

It now appears that perlite has been looked upon too generically and that not enough attention has been paid to individual types. AleXitE researchers now think that the class types (whether lithoidal, pumiceous, granular or onion-skin) result from different molecular structures and that the contained water is differently held in the different types. Many of the general types should be still further differentiated; for example, the granular should be classified as fine, medium or large, and the pumiceous as glassy-fine, medium or large-grain and pseudomorphic.

An interesting research project on the "structure" of perlite, differential thermal and petrographic analyses, may give intriguing answers on the detailed mechanism of the perlite popping process.

Finally, aside from research problems and operating difficulties, the perlite processing industry has many other problems. It competes to some extent with vermiculite, pumice, glass wool, and other lightweight materials. New uses for the product, however, may develop an independent market. Much depends upon research; much has already been learned.

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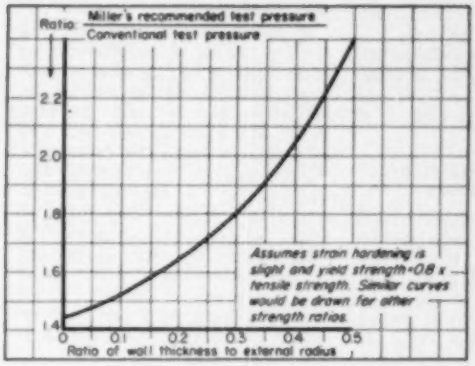
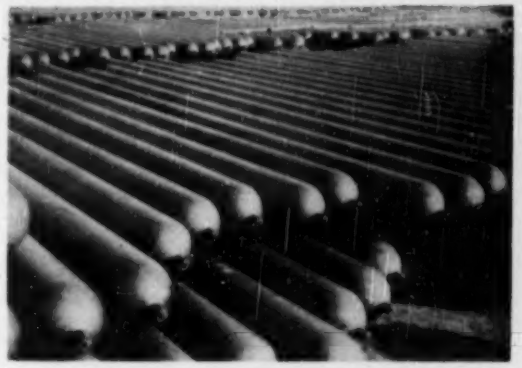
# Are Pressure Vessels Too Thick?




**Yes, says Benjamin Miller.** Note his higher test pressures. If he's right—a point hotly debated by high pressurists—our 100-year-old design rules waste money.



**And here's proof** that he may have something. Over 6,000 of these gas containers are operating at 2,240 psi.—more than double the working pressure allowed by conventional design rules.

BENJAMIN MILLER, consulting engineer of Ozone Park, N. Y., is an authority among high pressure designers. And on the subject of necessary wall thickness he is something of a maverick. His reasoning may not convince you, but you'll have something to think (and argue) about.

DURING the 1946-47 heating season there was placed in service near Kankakee, Ill., a natural gas storage system including 50 containers to operate at 2,240 psi. Since this first installation has proved successful, over 6,000 have been installed. This would not be remarkable were it not for the fact that 950 psi. is the maximum safe operating pressure for these containers under the most liberal interpretation of the rules generally followed by pressure vessel designers.

If these containers had been designed in the conventional way as pressure vessels to operate at 2,240 psi., the minimum shell thickness specified would have been at least 130 percent greater than the minimum which was actually specified. The safe and satisfactory operation of these containers is at least some evidence that conventional pressure vessel design would have made them much thicker than needed for safety, and therefore much too thick from the economic standpoint.

It is submitted that conventional pressure vessel design rules are based on notions which were first advanced more than a hundred years ago, at a time when practically nothing was known about the structure of metals; that such notions have long since been completely disproved; that following the conventional rules will almost always result in the specification of shell thickness much greater than necessary; and that safety with economy can be attained in pressure vessel design by applying what is now known about the structure and behavior of metals. In the paragraphs which follow there will be presented reasons for the statements just submitted, and some recommendations.

The ideas set forth herein are neither brand-new nor untried. They underlie the requirements of Section 2 of the American Standard Code for Pressure Piping which apply to Division 2 piping systems. Thousands of miles of cross-country pipelines for transporting natural gas at high pressure have been installed in conformity with these requirements, with an outstanding record of safe and satisfactory performance. The operating pressure of the containers near Kankakee mentioned above is what the maximum allowable working pressure would be under the Code for Pressure Piping if the vessels were part of a cross-country gas transportation system in Division 2; while there is a difference between storing gas and conveying it, no one would maintain that flow through a pressure vessel justifies a higher allowable pressure than would be safe in the absence of flow.

It is of interest that the first drafts of the Code for Pressure Piping included proposed rules similar to those generally used for pressure vessel design. When these drafts came to the attention of engineers in the natural-gas industry, it appeared to them that adherence to the proposed rules would make transportation of natural gas over long distances economically impossible. Accordingly, studies were made to find out on what ideas the proposed rules were founded and whether these ideas were valid. The conclusion reached in these studies was that the proposed rules were not soundly based. Further studies were then made to develop sound rules for cross-country gas pipelines, which were incorporated in the Code for Pressure Piping when it was issued as a tentative standard in 1935. These rules were retained when the Code was issued as a full standard in 1942, and they will be in the revised edition which is planned for issuance in 1950.* Sound rules for pressure vessel design could be developed in the same way. The present discussion is intended to point the way.

* The Code for Pressure Piping is now out of print. When the revised edition is ready in 1950 it will be available from the American Standards Association and the American Society for Mechanical Engineers.

For simplicity only cylindrical vessels will be considered, though much of what is said in a general way applies to spherical vessels also. The treatment is restricted to the ductile metals, such as the carbon and alloy steels commonly used for pressure vessels, and brittle metals such as cast iron are excluded. It is assumed that the temperature is uniform, and in the range in which the metal's mechanical properties are substantially those it has at room temperature; thus impact resistance and creep strength do not concern us. Corrosion is assumed to be negligible. The only loading is that due to a steady or slowly varying internal pressure, so that fatigue is not a factor. These assumptions would not be valid in all cases, but they focus attention on the question which is controlling in most pressure vessel design problems: how thick must the shell be to withstand the internal pressure without damage?

### SIGNIFICANCE OF LAMÉ FORMULA AND ITS LIMITATIONS

It is sometimes stated that in conventional pressure vessel design the Lamé formula is the basis for calculating the necessary shell thickness, which implies that any deviation from conventional design must be justified by disproving the Lamé formula. Such a statement betrays a superficial familiarity with the subject. The fact is, as has been pointed out repeatedly, that the Lamé formula gives only the relation between the pressure, the radii and the stresses in the metal:

$$S_T = \frac{PR_i^2}{R_o^2 - R_i^2}\left(\frac{R_o^2}{x^2} + 1\right) \qquad (1)$$

$$S_R = \frac{PR_i^2}{R_o^2 - R_i^2}\left(\frac{R_o^2}{x^2} - 1\right) \qquad (2)$$

where $S_T$ = tangential *tension* at any radius x, $S_R$ = radial *compression* at any radius x, $P$ = internal pressure, $R_i$ = internal radius of cylinder, $R_o$ = external radius of cylinder.

The assumptions upon which the Lamé formula is derived are (1) that the longitudinal stress, $S_L$, does not vary with x; (2) that strain is proportional to stress; and (3) that the stress-strain proportionality constants (Young's Modulus and Poisson's Ratio) are independent of x. These assumptions are approximately valid under the circumstances of our restrictions, the deviation increasing with the pressure, so that there is no need to question the applicability of the Lamé formula, at least as a starting point.

But a relation between the pressure, the radii and the stresses in the metal is not, in and of itself, a basis for calculating the shell thickness necessary for a certain pressure, or the maximum pressure allowable for a certain thickness. One might as well say that the formula for the kinetic energy of a moving body is the basis for establishing speed limits on highways.

The Lamé formula is useful in calculating necessary thickness or allowable pressure, but it can only be used after a decision has been made as to *what is to be limited*.

### MAXIMUM WORKING STRESS, TENSILE STRENGTH, FACTOR OF SAFETY

The notion which underlies current pressure vessel design rules is this: There is a maximum safe working stress, which is related to the minimum tensile strength of the metal, the ratio of minimum tensile strength to maximum safe stress being the factor of safety. Conservative designers take 5 as the factor of safety, while liberal designers use 4, though sometimes with the additional limitation that regardless of the tensile strength, the working stress shall not exceed a flat maximum of 15,000 psi. or 18,750 psi. For test purposes higher stresses are permitted—50 percent higher, or 100 percent higher, or sometimes the test stress may be unlimited except that it shall not cause visible distortion. The rationale seems to be that stress is harmful to metal, the extent of the damage increasing with the ratio of the stress to the tensile strength and the time during which the stress exists; the tensile strength is the stress which will destroy the metal immediately; a stress which is one-quarter of the tensile strength (or one-fifth) will require an extremely long time to destroy the metal and may therefore be used safely as the maximum allowable working stress; stresses above the maximum allowable working stress but substantially less than the tensile strength may be permitted for very short periods, if the total duration of excessive stress is a small fraction of the desired life.

Since by the Lamé formula the stresses due to internal pressure have maximum values at the inner skin and decrease regularly toward the outer skin, and since the tangential stress is everywhere greater than the radial stress, the current pressure vessel design rules seek to limit the tangential stress at the inner skin:

$$P_{max} = \frac{S_{max}(2R_i t - t^2)}{2R_i^2 - (2R_i t - t^2)} \qquad (3)$$

and

$$t = R_i\left[1 - \left(\frac{S_{max} - P_{max}}{S_{max} + P_{max}}\right)^{\frac{1}{2}}\right] \qquad (4)$$

where $P_{max}$ = maximum allowable working pressure, $S_{max}$ = maximum allowable working stress, $t$ = minimum allowable wall thickness, and $S_{max}$ is one-fourth the specified minimum tensile strength or less.

It should be noted that Eq. (3) and Eq. (4) are *not* variations of the Lamé formula; they are rules for maximum allowable working pressure and minimum allowable wall thickness. While the Lamé formula was used by those who formulated these rules, the fact that the Lamé formula (Eqs. (1) and (2)) is approximately correct does not prove that the rules (Eqs. (3) and (4)) are good. The rules depend for their acceptability on the reasonableness of the notion that it is unsafe for the stress at any point to remain for a protracted period at a value greater than one-fourth the tensile strength.

Some authorities think the operations of squaring and of extracting the square root objectionable, so that when $t$ is less than $R_o/3$ they use

$$P_{max} = \frac{S_{max}\, t}{R_o - 0.4\, t} \qquad (3a)$$

and when $P_{max}$ is less than $5S_{max}/13$ they recommend

$$t = \frac{P_{max}\, R_o}{S_{max} + 0.4\, P_{max}} \qquad (4a)$$

Eqs. (3a) and (4a), like Eqs. (3) and (4), are not consistent with what is now known about the structure of metal and the behavior of ductile metal when subjected to tension.

### HOW DUCTILE METAL FAILS IN TENSION

To determine the tensile strength of a sample of metal, a tension test specimen prepared from the sample is fractured in a tension testing machine. The specimen is symmetrical about an axis, and round or rectangular in cross section, the axial length of the specimen being at least several times its diameter or width. The machine subjects the specimen to a slowly increasing, constantly measured axial tension. The tensile strength is calculated by dividing the maximum load carried by the specimen during the test by the original minimum cross-sectional area. The result obtained is quite sensitive to the shape and dimensions of the test specimen, which have therefore been carefully standardized by ASTM.

If the length along the axis between two gage marks on the specimen is measured during the test, it is found that the specimen elongates as the load is increased. Measurements at right angles to the axis show lateral contraction. With the metals we are

considering, the strains are at first at least approximately proportional to the stress, but later the strains increase more and more rapidly, until just before the maximum load is reached each increment of load causes a very large increase in length and a large decrease in cross-sectional area.

If the test is interrupted before fracture, and the load removed, the specimen contracts axially and expands laterally. If the stress has not been in excess of a critical value, called the elastic limit, the specimen regains its original dimensions; otherwise, the strains were in part elastic and in part plastic, and the specimen has experienced a permanent deformation. The exact value of the elastic limit is very difficult to determine; the more sensitive the strain-measuring instrument, the lower the elastic limit is found to be. This is relatively unimportant, because it has been found that the structural value of metal is not adversely affected by a steady load, no matter how great nor how long imposed, which does not cause substantial *plastic* strain. For this reason the maximum safe tensile stress can be set at a value which corresponds to a small, but well-marked, plastic elongation, of the order of 0.1 to 0.3 percent. This stress is qualitatively the same as the yield strength, which the ASTM defines as "the stress at which a material exhibits a specified limiting permanent set."

The mechanical property of a ductile metal of primary importance from the pressure vessel standpoint is the yield strength, and the tensile strength is important only in so far as the spread between yield strength and tensile strength indicates ductility.

A complete description of the failure of ductile metal in tension would require a much longer excursion into the field of the science of metals than space permits, but at least a brief statement is essential. The metals which we are considering are polycrystalline materials, each crystal or grain being formed by positively charged atomic kernels arranged symmetrically about certain axes, electrical neutrality being maintained by electrons which are distributed through the mass and are free to move within the crystal or from one crystal to another. At the grain boundaries there are abrupt changes in the directions of the crystal axes, so that there the atomic kernels (or atoms, as they will be called below) form a transition region.

The atoms occupy positions in the grains which are determined by the equilibrium of interatomic forces, attractive and repulsive. When a piece of metal is subjected to a small tension, the atoms are required to move apart along the direction of the pull. This changes the balance between repulsive and attractive forces, causing a net increase in the attraction, and the movement along the direction of the pull ceases when the increase in the net attraction balances the external load. At the same time the atoms are brought together laterally. When the load is released, the atoms go back to their equilibrium positions.

If instead of releasing the load, it is increased, more profound changes take place in the structure of the metal. A crystal is not equally strong in all directions. There are some planes which contain fewer atoms than others, or contain atoms so arranged that movement along the plane can develop only small resisting forces, and when the pull exceeds the resisting force the crystal breaks. As the tension is increased the components of the force along and across these planes of weakness increase also, the magnitude of each being determined by its orientation with respect to the direction of pull. As the crystals are oriented in all directions, the force along a particular plane of weakness in some crystal will reach a limiting value. Then that crystal will cleave along that plane, and one part of the crystal will slide along the other part. As the increase in tension continues, other crystals will cleave, and eventually there will be a general breakdown in substantially all of the grains. At this stage the metal has become almost entirely plastic; that is, the atoms can move by one another very readily along all planes. Then the distance between the atoms along the direction of the tension ceases to increase; instead, there is a lateral movement of atoms toward the center which compensates for the axial movement, and keeps the concentration of atoms fairly constant. The ability of the piece to carry the increased load is due to this bringing in of atoms toward the center, and to the progressive elimination of the planes of weakness. Eventually, however, the process becomes concentrated at one location, and the cross-section at that location decreases rapidly. The force developed per atom continues to increase, but the number of atoms in the minimum cross-section decreases, so that the load reaches a maximum value, then decreases. Soon thereafter the increase in attraction developed by moving the atoms apart reaches its maximum, and then the piece fractures.

If the increase of load is halted after the metal has become plastic, but before local thinning has started, and the load is then maintained constant, no further deformation occurs. The atoms soon take up new equilibrium positions close to those which they occupied when the steady-load period started, and the plasticity disappears. The planes of weakness which were eliminated do not return, so that the metal is better able to carry load than it had been before.

If the load is quickly removed after the metal has become plastic but before local thinning has started, the plasticity decreases before the atoms have taken up new equilibrium positions. If the piece is immediately reloaded, the plasticity increases markedly at a fairly low load, but the atoms then take up new equilibrium positions, so that when the load has increased to the maximum previous load, the plasticity is less than it had been when that load had first been imposed. If the piece is allowed to remain unloaded for a period of several hours, the atoms take up new equilibrium positions and the plasticity disappears; the change can be speeded up by raising the temperature moderately, a few minutes being sufficient at 212 deg. F.

### PRACTICAL SIGNIFICANCE OF YIELD STRENGTH AS BASIS OF DESIGN

If the yield strength were always and for all materials the same fraction of the tensile strength, it might be said that there is no practical difference between basing the allowable stress on the yield strength and basing it on the tensile strength. The fact is that the ratio of yield strength to ultimate strength varies considerably, even in steels of a single general class; in one series of tests of structural steel the ratio of yield strength to tensile varied from 0.49 to 0.64.

The metallurgists have developed carbon and low alloy steels which are relatively inexpensive but have much higher yield strengths than the ordinary steels generally used for unfired pressure vessels. For example, casing for oil and gas wells is now regularly furnished in accordance with American Petroleum Institute specifications which require a minimum yield strength of 55,000 psi. (with a minimum tensile strength of 75,000 psi. and a minimum elongation of 20 percent in 2 in.) for Grade J-55, and a minimum yield strength of 80,000 psi. (with a minimum tensile strength of 100,000 psi. and a minimum elongation of 16 percent in 2 in.) for Grade N-80, but such material was not listed in 1935. When the production branch of the oil industry learned that economical production of oil from great depths required casing

with high yield strength, the steel industry made it available.

There never was any logical way to decide upon a factor of safety, because it had to include a factor of ignorance as to the damage done to the metal by stress. When the yield strength is used as a basis of design, no such factor of ignorance enters the calculations. If the stress does not exceed the yield strength, the metal is not damaged. Since stress calculations can be made by the Lamé formula up to the yield strength, and the design can be checked by test, the only allowance necessary is for uncertainty in the working pressure itself.

### GAS STORAGE CONTAINERS

The gas containers installed near Kankakee for operation at 2,240 psi., which were mentioned at the beginning of this article, were made to comply with the API specification for Grade N-80 casing. Their external radius is 12 in. and their guaranteed minimum shell thickness is 0.448 in. Using a factor of safety of 4 the maximum allowable working stress would be 25,000 psi., from which, by Eq. (3) or (3a) the maximum allowable working pressure would be 950 psi.

The Code for Pressure Piping sets the maximum allowable working pressure for cross-country gas pipelines at 80 percent of the pressure at which the pipe was tested at the mill, provided that the mill test pressure does not exceed a value computed by the formula

$$P_{mt} = \frac{0.9Kt_n}{R_o} \qquad (5)$$

where $P_{mt}$ = maximum test pressure, $K$ = stipulated minimum effective yield strength, $t_n$ = nominal wall thickness.

The underthickness tolerance permitted by the API standard is 12½ percent so that the nominal thickness of these containers is 0.512 in. The maximum test pressure permitted by Eq. (5) is therefore 3,072 psi. The actual test pressure employed was only 2,800 psi., which corresponds to a maximum allowable working pressure of 2,240 psi.

It should be noted that gas piping systems in industrial plants are covered in the Code for Pressure Piping by rules which differ from those which apply to cross-country pipelines, but according to these rules also the yield strength is the basis for design. The relation between pipe dimensions, pressure, and yield strength applicable in most cases is given by

$$t = \frac{P_{max} R_o}{0.6K + 0.4P_{max}} + \frac{600}{K} \qquad (6)$$

The maximum allowable working pressure for the Kankakee containers would be 1,790 psi. by the rules which apply to gas piping systems in industrial plants under the Code for Pressure Piping.

### THE PROBLEM OF THICK-WALLED VESSELS, PRESTRESSING

The ratio of the minimum tangential tension, $S_{T_o}$, which occurs at the outer skin, to the maximum tangential tension, $S_{T_i}$, is given by the Lamé formula as

$$S_{T_o}/S_{T_i} = 2R_i^2/(R_i^2 + R_o^2) \qquad (7)$$

and decreases as $R_i/R_o$ does, but more rapidly; thus when $R_i/R_o$ is 0.5, the stress-ratio is only 0.4.

When the stress variation was considered in connection with the assumption that it is unsafe to let the greatest stress exceed a certain limiting value, it appeared that only the metal near the inner skin could be used effectively to resist internal pressure, and the addition of metal by increasing the external radius would add very little to the maximum allowable working pressure. About 100 years ago it was suggested that more effective use of metal could be made by giving the vessel shell an initial stress distribution such that when the internal pressure was applied the resultant stress would be more nearly uniform. This required that in the absence of pressure the tangential stress be compressive at the inner skin, decrease to zero at some intermediate radius, then become tensile and increase to the outer skin.

Several methods of setting up such an initial stress distribution were used, including the shrinking of one cylindrical shell onto another; the winding of layers of wire on a thin shell; the building up of thick shells by wrapping sheets around a thin shell, each layer being welded; the winding of interlocking layers of heated tape on a thin shell; and a method called autofrettage, which comprises subjecting the shell to an internal pressure high enough to make the metal near the inner skin plastic but not the metal near the outer skin, then releasing the pressure whereupon the elastic contraction of the outer portion of the shell compresses the inner.

Much has been written about prestressing, including methods of calculating the initial stress distribution, but the practical value of the published material is questioned because of the assumption on which it is based. When the notion that stress is harmful in and of itself is discarded and there is adopted instead the principle that excessive plastic strain is the thing to guard against, the thick-walled vessel problem takes on another aspect. Uniformity of stress throughout the wall thickness under internal pressure no longer appears desirable, and prestressing is not to be regarded only as a means to achieve such uniformity.

Consider a thick-walled vessel under a slowly increasing internal pressure. The tangential stress increases approximately in accordance with Eq. (1) until the yield strength is reached at the inner skin. If the increase in pressure is halted at that point, and the pressure maintained, the metal of the shell is still elastic, and undamaged, and the pressure can be maintained indefinitely. If the increase in pressure is not halted when the metal at the inner skin becomes plastic, but instead the pressure continues to increase slowly, a region of plasticity spreads through the shell. The Lamé formula is no longer applicable, because the assumptions on which it is based are no longer valid. The tangential stress in the still-elastic portion of the shell now increases more rapidly with the pressure than would be calculated by the Lamé formula, while in the plastic portion the tangential stress increases less rapidly, or not at all, depending upon the rate at which the pressure is increasing and the strain-hardening characteristics of the metal.

The essential point is that the plastic strain cannot be very great until the plastic region has reached the outer skin, since the plastic metal has no place to go except into the space made available by the expansion of the surrounding elastic metal.

The maximum safe internal pressure for a thick-walled vessel is therefore the pressure which will just make the metal at the outer skin plastic. To design a thick-walled vessel for a stipulated maximum pressure it is necessary to know the stress-strain behavior of the metal well into the plastic range so that the strain-hardening characteristics can be taken into consideration; however, the thickness needed will not exceed the value calculated on the assumption that the metal does not strain-harden.

The pressure for which the vessel is to be designed is the test pressure; the maximum allowable working pressure may then be set at a fraction of the test pressure, the fraction being chosen with regard to the circumstances. Where failure would result only in damage to the vessel and loss of its contents, the fraction might be as great at 4/5; where other property might be damaged or personnel endangered, it might be 2/3 or less.

**DEPARTMENT OF THE MONTH**
*One of twenty service features in each issue of Chemical Engineering*

# Chemical Engineer's Bookshelf

*LESTER B. POPE, Associate Editor*

## The Chemical and Process Industries

INDUSTRIAL CHEMISTRY. Fifth edition. By Emil Raymond Riegel. Reinhold Publishing Corp., New York. 1,015 pages. $7.

Most important of all the books on our shelf this month is Riegel's new edition. For 20 years, in all its editions, "Industrial Chemistry" has been answering questions for engineers and for students in more than 200 schools in this country and abroad. It is serving well. Otherwise its total sales in five editions would not have been what they were. Nearly 65,000 Reinhold says. The publisher expects the sales curve to continue its trend —first printing of the fifth edition was 10,000.

Meticulous, affable Emil Raymond Riegel was born on Bastille Day, 1882, in Metz. He joined his brothers in this country while he was still a youngster. He was educated at Harvard and received his B.S. magna cum laude—precocious but no prodigy. After master's and doctor's degrees he went to work in industry. He joined the University of Buffalo faculty just about the time the school—needing more room—took over the Erie county poor farm. An architect redid the school. Riegel built his part of the chemistry department.

With the curiosity of a small boy, plant-visitor Riegel finds out everything. His notebooks are crammed with details that became a first and subsequently a fifth edition of "Industrial Chemistry." The book's errors are of omission, he has his friends check everything before publication.

This adding and checking is evident in comparing the fourth and fifth editions. On practically every page there are changes or added information on current practice.

But in many chapters there are whole sections either new or completely rewritten. These are the places which made the new edition necessary—necessary because of the number of advances in the chemical process industries. These advances which practically constituted new processes were not properly described or not represented at all in the fourth (1942) edition. As James Lee said more than 20 years ago in commenting on the first edition, "Processes are changing at such a rapid rate that, to keep up with the procession it would be necessary to constantly revise books in industrial chemistry." Prophetic.

**E. R. Riegel**
*"magna cum laude"*

Examples of this forced expansion are Riegel's new pages on Reppe chemistry, antibiotics, color photography, plastics, rubber, petroleum and synthetic organic insecticides. In these fields there were changes and advances. They are reflected in extended sections.

Completion of the present edition was delayed for various reasons. An advantage, the author found, was that he could include 1947 Census of Manufactures data which became available last summer. These price and production figures are vital in industry. The average undergraduate probably doesn't get enough exposure to the tonnages and dollars that are so important. Riegel will help build an appreciation of the fact that industries are built on economics as well as technology.

An interesting feature of the book are the drawings. Many of them were drawn by the author. (The percentage of them, however, decreases with new editions because industry now supplies more illustrations of equipment and flowsheets of processes.) Why did he go to all that trouble? We asked him; we asked the publisher. Riegel says he originally intended to make them all, to keep them simple, to show working principles without constructional details. He also says he found it advisable to enlist the assistance of draftsmen in later editions. The publisher says that he enjoys doing it; he is very meticulous and likes to have things just right; he is thrifty and authors, not publishers, pay for drawings.

Dr. and Mrs. Riegel live in Buffalo proper. When the notorious weather is at its worst he is near enough to walk to work, which he does regularly anyway. They summer in Westbrook, Conn. Their hobby has been the restoration of an old New England home. Now with "Industrial Chemistry" out of the way for a while, Riegel is hard at work on a revision of his "Chemical Machinery." Such industry doesn't leave much time for hobbies.—*LBP*

### Philosophy

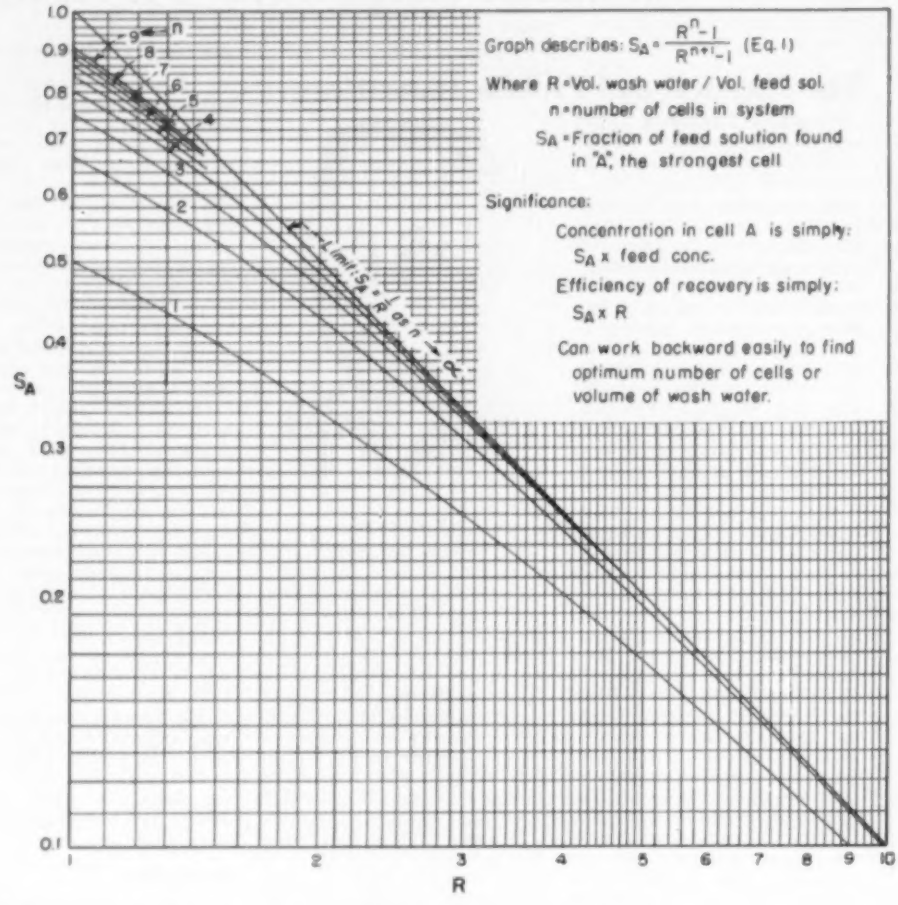
SCIENTIFIC AUTOBIOGRAPHY AND OTHER PAPERS. By Max Planck. (Translated by Frank Gaynor.) Philosophical Library, New York. 192 pages. $3.75.

*Reviewed by F. C. Nachod*

It must have been some 15 years ago when this reviewer sat in a tightly packed audience in the Kaufhaus in Leipzig and listened to Max Planck's discourse on free will and causality. Dr. Planck held his audience spellbound and his quiet, logical approach to some of the most vexing problems introduced

(*Continued on p. 249*)

# Countercurrent Decantation: New Approach Makes Calculations Easy




**Switched from weight basis to volume basis; eliminates laborious simultaneous equations. Key equation is plotted (see legend on graph). Sample problem at beginning of text shows simplicity of mathematics.**

**M. G. MASTIN**

Many papers have been written on continuous countercurrent decantation, but so far as is known, none of the proposed schemes has been widely adopted, perhaps because of the involved nomenclature and complicated calculations. The method of setting up simultaneous equations is still more or less universally used despite the laborious nature of the operation.

A simplified method has been developed which depends on making volume calculations instead of using weights. To demonstrate the simplicity of the method an example will be given prior to further discussion.

M. G. MASTIN *is president of Basic Reduction Co., Henderson, Nev. In his business (production of lead and zinc) the washing of sludges and slurries is an ever-present job—and the calculations an ever-present headache.*

### SAMPLE PROBLEM

A three step tailings wash system is to be used to recover caustic soda. The cells are labeled *A*, *B* and *C*. The

tailings are composed of inert solids wet with a solution of caustic containing 2.05 lb. NaOH per gal. and are fed into A. Wash water at the rate of 2 gal. for every gallon of caustic solution is fed into C. The ratio of wash water to original solution is then 2, equal to R. The number of steps is denoted by n. What is the composition of the solution in A, and what is the percentage recovery?

The composition of any A tank in any wash series, in terms of the proportion of original solution in it, is

$$S_A = \frac{R^n - 1}{R^{n+1} - 1}$$ In this example

$$S_A = \frac{2^3 - 1}{2^4 - 1} = 0.4666$$

Multiplying this value of $S_A$ by $C_o$, the concentration of the original solution: 0.4666 × 2.05 = 0.9566 lb. NaOH per gal. in A tank. This value is denoted by $C_A$. The efficiency of recovery is found from $(C_AR/C_o)$ (100) = $(S_AR)$ (100) = (0.4666) (2) (100) = 93.33 percent.

Further consideration of the above example shows that when the efficiency of recovery is the only answer sought, it is unnecessary to calculate the composition of the several cells since the value of $S_A$ is the only unknown required.

There are many types of problems that fall under the heading of CCD calculations. For the equations given below, several simplifying assumptions have been made which somewhat limit their application. These assumptions are: (1) The solute in the feed to the system is already in solution in the solvent. (2) Complete equilibrium is established in each cell. (3) The solute is not absorbed by the solids. (4) The volume of liquid in the underflow is the same for each step, although the composition changes from cell to cell. (5) The volume of underflow from step to step is constant. (6) The volume of solids in the underflow is not included in the calculation. If the volumes of any of the items in 4, 5, or 6 change from step to step, suitable modifications of the formulae will suggest themselves.

NOMENCLATURE

- $C$ Concentration of the solute on any weight per volume basis.
- $C_o$ Concentration of the solute in the original solution entering the system with the inert solids to be extracted.
- $C_A$ Concentration of the solute in the mixture of original solution and wash water in $A$, the strongest cell.
- $C_B$ Concentration in cell $B$, etc.
- $S$ Fraction of original solution of concentration $C_o$ found in any cell.
- $S_A$ Fraction of original solution of concentration $C_o$ found in cell $A$, etc.
- $R$ Volume ratio of wash water to original solution. Equals gal. overflow per gal. of underflow solution.
- $n$ Number of cells in system.

(7) Fresh solvent to the system contains no appreciable solute.

Without taking up space to develop the mathematical proof, the equations for the composition of any cell in any series for any values of $R$ and $n$, in terms of the fraction of original solution of concentration $C_o$, may be written at once:

$$S_A = \frac{R^n - 1}{R^{n+1} - 1} \quad (1)$$

$$S_B = \frac{R^{n-1} - 1}{R^{n+1} - 1} \quad (2)$$

$$S_C = \frac{R^{n-2} - 1}{R^{n+1} - 1} \text{ etc.} \quad (3)$$

When $R$ equals unity the numerator reduces to zero and we get an indeterminate form. In this case, apply the method of l'Hôpital. Differentiate both numerator and denominator with respect to $R$ and the desired value of the original fraction will be obtained as the ratio of the derivatives, evaluated at $R = 1$. Then when $R = 1$

$$S_A = \frac{nR^{n-1}}{(n+1)R^n} = \frac{n}{n+1} \quad (4)$$

Then $C_A = S_A \times C_o$; $C_B = S_B \times C_o$; $C_C = S_C \times C_o$; etc.

Based on 1 gal. of original solution entering the system: $C_o \times R$ = lb. solute recovered in $R$ gallons of $A$ overflow; $C_o - (C_AR)$ = pounds solute lost in 1 gal. of weak cell underflow; 100 $C_AR/C_o$ = percent solute recovered, at concentration $C_A = 100\ S_AR$.

SUPPLEMENTARY DISCUSSION

Eq. (1) above is to be used in all cases where given values of $R$ and $n$ are known. In the case where $n$ is not known, but we have values of $S_A$ and $R$, Eq. (1) may be rewritten:

$$n = \frac{\log (1 - S_A) - \log (1 - S_AR)}{\log R} \quad (5)$$

Sometimes the case arises where $A$ overflow must have some definite concentration, $C_A$. Referring to our example above, $C_A = 0.9566$, and $S_A = C_A/C_o = 0.9566/2.05 = 0.4666$. Then substitute this value in Eq. (1)

$$\frac{R^n - 1}{R^{n+1} - 1} = 0.4666 \quad (1a)$$

Rearranging, $R^{n+1} - R^n/0.4666 + 1/0.466 - 1 = 0$; and

$$R^{n+1} - 2.1428R^n + 1.1428 = 0 \quad (6)$$

Unfortunately, for values of $n$ greater than unity, this equation is not easy to solve.

Perhaps the simplest procedure is to substitute various values of $R$ and $n$ in Eq. (1a). This method is made easy by use of the graph. Tabulating the values of $R$ and $n$ that give $S_A = 0.4666$, we find:

| $n$ | $R$ | % Recovery, 100 $S_AR$ |
|---|---|---|
| 1 | 1.143 | 53.6 |
| 2 | 1.75 | 86.1 |
| 3 | 2.0 | 93.3 |
| 4 | 2.08 | 97.1 |
| ∞ | 2.143 | 100 |

In this case, the cost of a fourth step was more than the value of the added recovery, and therefore a system of three cells using a wash ratio of two was adopted. In this connection it should be noted that the maximum change in $R$ is unity for any given value of $S_A$ and for any value of $n$ between one and infinity. This is evident from an inspection of Eq. (6). This consideration somewhat simplifies the selection of values of $R$ for substitution in Eq. (1).

BATCH EXTRACTION

This method contemplates the use of a single extraction unit which contains the solids to be washed and to which is added fresh wash solvent followed by agitation and settling. Repeated extractions are performed in the same unit by making successive additions of fresh solvent. In this case, $n$ refers to the number of such extractions.

In terms of $R$, the volume fraction of original solution $S$ left after $n$ wash steps is indicated by

$$1 - \left[\frac{R}{R+1} + \frac{R}{(R+1)^2} + \frac{R}{(R+1)^3} + \cdots\cdots \frac{R}{(R+1)^n}\right]$$

equals $\frac{1}{(R+1)^n}$

USE OF WASH SOLVENT CONTAINING SOLUTE

If the fresh solvent to the system contains appreciable quantities of the solute to be recovered, let $Y$ equal the volume fraction of the entering wash solution that has the same composition as the original solution entering with the solids, concentration $C_o$. For example, let the fresh wash be a 1.5 percent aqueous solution of salt, and the brine to be removed from the solids a 25 percent solution of salt. Then the wash solution is made up of 6 percent of 25 percent brine and 94 percent water, and $Y = 0.06$. The $S$ fraction of cell $A$ is then:

$$S_A = \frac{(R^n - 1) + YR^n(R - 1)}{R^{n+1} - 1}$$

In our original example, $R = 2$, $n = 3$, and now $Y = 0.06$. Substituting:

$$S_A = \frac{(2^3 - 1) + 0.06\,(2^3)\,(2 - 1)}{2^3 - 1} = 0.4986$$

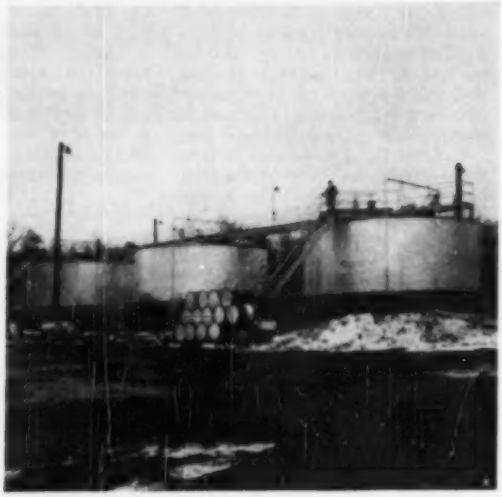
and $C_A = 1.022$

MONSANTO MAKES ITS OWN

# FORMALDEHYDE

**Advantages are:**

**Uniform product**
**High concentration**
**Dependable supply**
**Lower cost**



LESTER B. POPE

**MONSANTO** uses a lot of formaldehyde. An investigation of their needs showed them that it would probably be economically sound to make their own.

So research was started at Monsanto's Dayton laboratories. Pilot plant proof was obtained and Monsanto engineers in Springfield, Mass., and St. Louis designed a plant. Construction by a local contractor under Monsanto supervision began in Springfield October 1947.

When everything was ready, Monsanto played it smart. They sent the operators to school. For a month everybody studied. Reactions, valves, pumps, converter, tower —everything was familiar before the plant went on stream. Highly commendable. Some methanol-air mixtures are explosive. And formaldehyde can be unpleasant if it is not handled properly.

The unit was started early last year. After the few "bugs" that always infest new processes were exterminated, the unit has operated as it should. Designed capacity is 75 million pounds per year. This is much more than enough to take care of the needs of Monsanto. Approximately a third of what they are turning out is sold and two-thirds used for phenolic resins, Formvar and other Monsanto products.

Two grades are available: "methanol-free" (containing about 2 percent methanol) and "methanol-containing" (with about 7 percent methanol). The process actually turns out a low methanol content product.

Chemistry of the process has been described in *Chemical Engineering* and elsewhere. (See, for example, *Chem. Eng.* Feb. 1949, pp. 130-131.) There are two main reactions. (Other side reactions take place, too. These give small percentages of CO, $CO_2$, HCOOH, $HCO_2CH_3$, and $HCH(OCH_3)_2$. Such byproducts are largely removed in the absorber and deacidifier.)

$$CH_3OH + \tfrac{1}{2}O_2 \rightarrow HCHO + H_2O$$
$$CH_3OH \rightarrow HCHO + H_2$$

Vaporized methanol, washed air and steam are mixed and passed through a catalyst and the product formaldehyde is absorbed in water. Sounds simple? It isn't; some real chemical engineering skill went into making it work.

L. B. POPE, *associate editor, went to Springfield last fall to get the material for this article.*

**METHANOL** is kept in three storage tanks (see cut) until needed for the process.

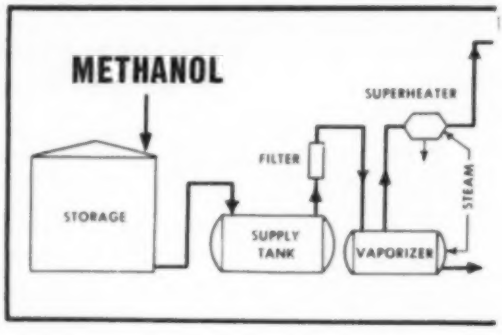
Methanol comes to the plant by tank car and is pumped from the siding through a filter to storage. The three 100,000-gal. tanks are diked. Of course each tank has its own level indicator and relief vent.

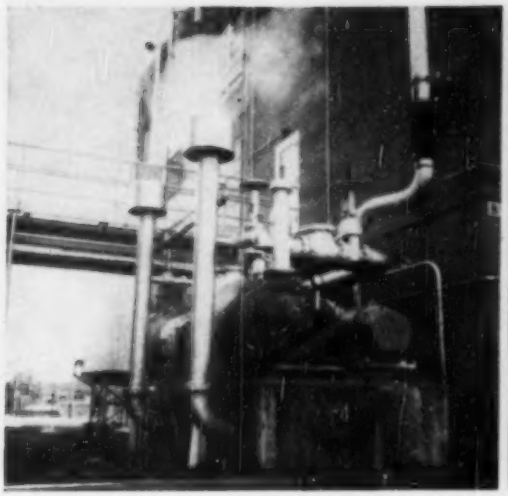
First thing that a shift does when coming on duty is to meter enough from storage to fill the supply tank. This much will feed the process until the next shift shows up to fill the tank again.

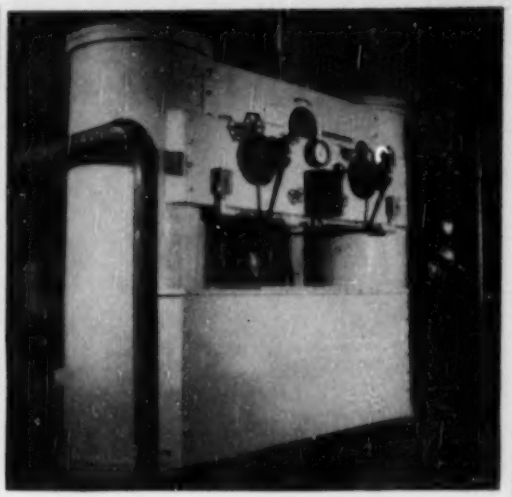
All the while the formaldehyde unit is on stream a dual pump in continuous operation draws methanol from the supply tank. It passes through a porous stone filter to a vaporizer. From the vaporizer (at about 15 psi.) it goes to the superheater which raises the temperature to about 115 deg. C. Hot vaporized methanol next goes to the mixer that feeds the converter. Flow is controlled by a volumetric controller; pressure by regulating steam fed to vaporizer; and temperature by steam fed to superheater.

Copper and copper alloys are the materials of construction that Monsanto uses in handling methanol.

Safety is always the watchword in a chemical plant and at Monsanto it is even more. It has to be in a unit that is practically capable of running itself. There are two "howler" alarms along the methanol route. One announces a low level in the supply tank. The other goes off if the level gets too low in the vaporizer.







**AIR,** second raw material, is grabbed by a couple of positive displacement type blowers (above) and shoved through the process. These operate in parallel and if one cuts out, its standby mate takes up the job. They pull atmosphere through a maze filter and push it at about 11 or 12 psi. to an air cleaner (wet) where it is washed and concurrently scrubbed. A mat takes out entrainment. A superheater (using process steam) raises temperature to about 107 deg. C. The hot air now goes to the mixer through a jacketed duct warmed by plant steam.

Air is used in the conversion process at a rate of better than 4 tons per hr. This is nearly twice as much as the methanol and three times the steam rates. Moisture becomes steam in the superheater and enters the converter as such. Of course oxygen is the only constituent of air that enters the reaction. The nitrogen passes through unchanged, goes out the vent of the absorber with other non-absorbed products.

The whole conversion process is controlled by regulating the flow of the air. A temperature recorder-controller on the converter is tied to a flow recorder-controller in the air line. So a drop or rise in reaction temperature immediately signals for and gets correction.

Air pressure is regulated by a pressure recorder-controller connected to the hot side of the superheater. It regulates a bypass valve on the blower. It, too, has a howler to warn the operators if pressure gets too low.

**WATER,** third raw material, is taken from Springfield's municipal supply and de-ionized (de-ionizer shown above). Water is used: (1) in the air scrubber, (2) in the absorber, (3) in formalin make-up to 37 percent, and (4) to make steam. Steam is used (1) in the reaction, (2) to vaporize methanol, and (3) to superheat reaction air. (Ordinary plant steam is used for other heating.)

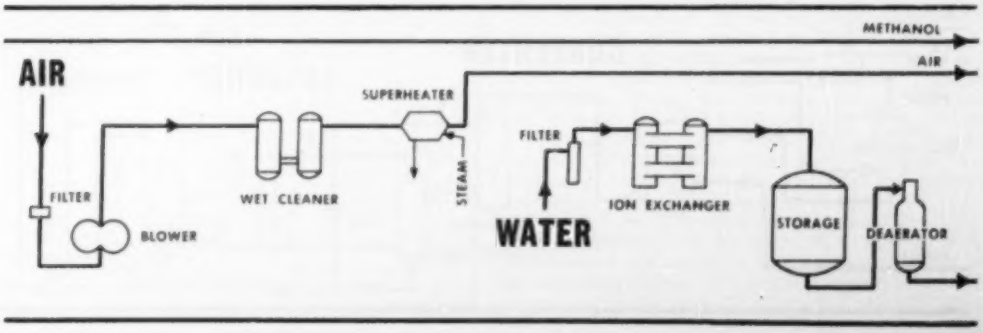
City water comes to the formaldehyde unit, is filtered and passed through the de-ionizer (CCF resin) to outdoor steam heated storage.

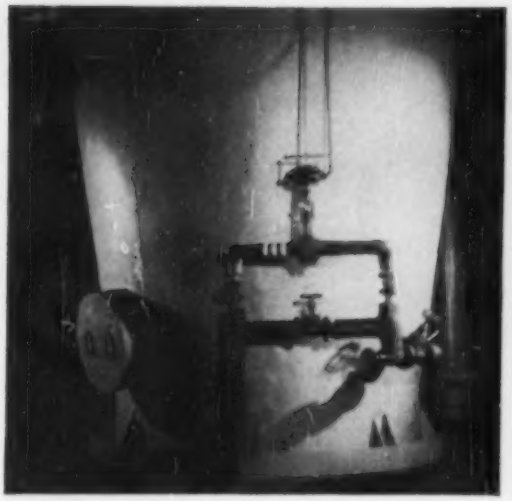
Steam for the reaction is generated by the reaction. Deaerated water going through a shell-and-tube condenser in the converter cools reaction products and becomes steam. This steam goes through a small bubble-cap tower which washes it and takes out entrainment. About half the steam goes to process and half to vaporize methanol and superheat air.

Process steam enters the mixer through a flow recorder-controller in this line. The steam system also has its howler alarm attached to a pressure recorder-controller.

A plant-steam-operated steam generator (not shown in the flowsheet) takes care of the start-up steam, and contributes part of the requirements when the process is going full tilt.

A water cooling tower (not visible in the illustrations) takes care of cooling requirements in only three spots: the formaldehyde condenser and the intercoolers.





**CONVERTER,** (body of which is shown above) is stainless steel (Type 347).

It is the heart of the whole formaldehyde process. The three reactants come to it in the proper proportions through a porous metal vapor filter. They pass through the catalyst bed where reaction takes place. The gases at high temperature are immediately quenched in the shell-and-tube exchanger. They then go to the condenser.

Exit gases from the converter are mainly formaldehyde, steam and nitrogen. Other products are methanol and carbon dioxide with traces of carbon monoxide, hydrogen, ethylene, methane and formic acid. The nitrogen and all the minor ingredients go out the vent on top of the absorber.

As the plant was originally designed, electrically heated nitrogen served as a purge and to bring the catalyst to operating temperature. After operations commenced it was found that modifications were necessary to do the job.

You will be correct in guessing that the converter is fully instrumented and safe.

The converter's temperature recorder-controller has already been mentioned. In addition, there is a rupture disk near the top; a relief vent, gage glass and pressure indicator near the side; a level indicator-controller on the water supply near the bottom. (Here's where one howler is. There are a half dozen more attached to temperature recorders probing the converter's innards.)

**ABSORBER,** condenser and condenser surge tank—all of 347 stainless—comprise the recovery system. (Part of the absorber is shown above.)

The hot gases from the converter are subjected to a desuperheating spray of condensed product. They come to the condenser at 120-170 deg. C. Cooling water flow and temperature are controlled. Here, again, an alarm audibly announces trouble when water flow isn't right.

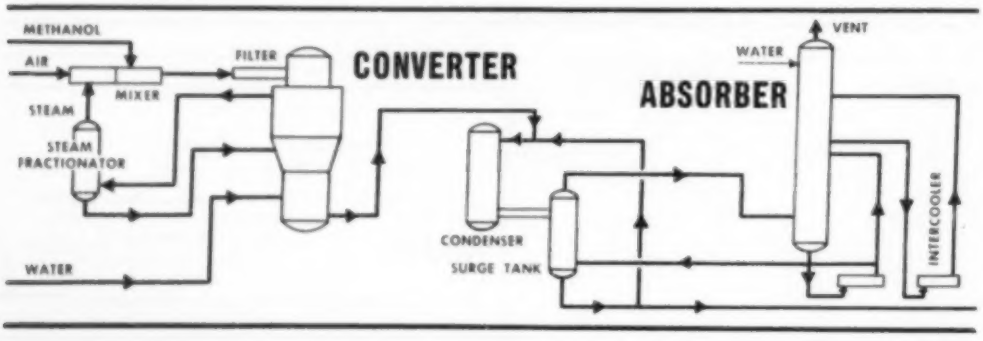
A surge tank (separator) on the condenser sends liquid to product storage and gases to the absorber. (This separator has a low-level alarm.)

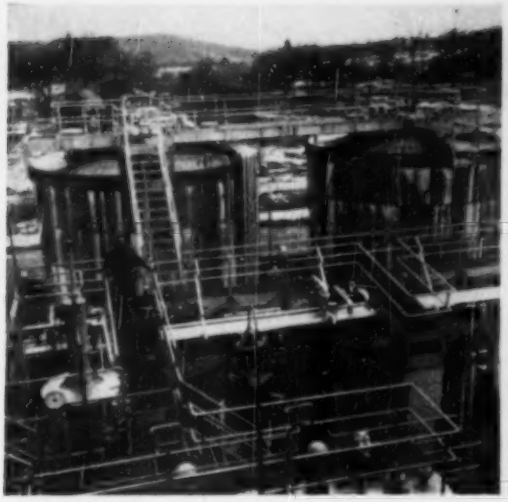
Gases enter the bottom of the bubble-plate absorber at about 40 deg. C. De-ionized water goes in the top at 30 deg. C. (There's an alarm on the water flow recorder-controller and also on the column's liquid level indicator-controller.)

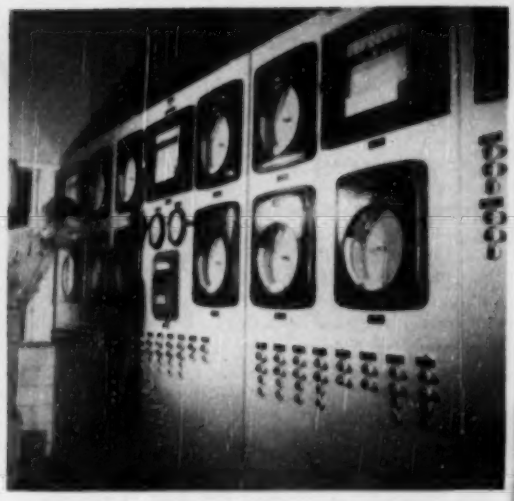
Two intercoolers are necessary to keep the heat down. Water for these comes from the water cooling tower.

Unabsorbed gases, as has already been mentioned, go out to the atmosphere through the vent at the top. Absorbed product is cooled and returns to the surge tank at about 40 deg. C.

The product to storage, that is, mixed condensate and absorbate, is nearly 5 tons per hr. of 37% formaldehyde with 2% methanol. It is run through an ion-exchange deacidifier which cuts down the formic acid content. Formic decreases stability.







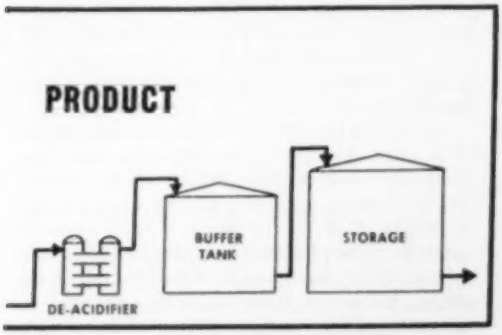
**STORAGE** is no problem. There are two storage tanks (see cut above) from which material is drawn as needed. A direct pipeline connects to the Resinox and Shawinigan plants. A second line connects to the railroad siding for tank car loading and to a dock for filling trucks.

There are three so-called "buffer" tanks. (You can see the tops of two above. That's the top of the methanol supply tank barely visible in the foreground.) These are 10,000 gal. each; each big enough to hold a shift's production. Actually the process is very flexible and the buffer tanks are big enough to hold a shift's production when the unit is operating at the maximum rate.

The buffer tanks have propeller agitators because here is where de-ionized water is added to adjust product strength to exactly 37 percent. Here is where they add the alcohol to produce 7 percent "methanol containing" formaldehyde solution.

Each of the three buffer and two storage tanks is steam heated. Each has a relief vent, level indicator and temperature recorder that sounds off when things get too hot or too cold. Each was made of mild steel and is plastic composition lined.

Formaldehyde, as is well known, will polymerize. It proceeds slowly even though inhibited by methanol. Production at Monsanto, therefore, is scheduled carefully. They keep enough on hand to meet requirements, but not enough to have trouble with polymerization products.




**INSTRUMENTATION** and control of the whole formaldehyde process is centralized at one spot (see cut). In this room are the recorders that keep a permanent record of what is going on at all times—even when the plant isn't running, a record is made of product temperatures. In this room are the signal lights that indicate where trouble is if it occurs—and the push buttons that make corrections and start things going again. In this room is a little lab bench—gas analyses can be made if the operator has to make any checks. In this room the air pressure is maintained slightly higher than on the operating floors—a safety precaution that keeps any stray fumes from wandering in.

The plant isn't very large but the instrumentation is impressive. There are more than 130 spots where some variable is measured or controlled or both. They have variety. There are two dozen different types ranging, for example, from the simple gage glass on the methanol supply tank to the much more complex level indicator-controller-alarm on the converter. Of the 130 total, more than one-third are recorders. Alarms, already mentioned, are connected to 25 instruments to call operators' attention immediately to any condition that needs correcting.

Pressure and temperature are, of course, the two variables requiring the most instruments—86 of both. It is interesting to note that of 40 pressure gages and controllers, only 3 are recording. On the other hand, of the 46 thermometers, pyrometers and temperature controllers, 40 are connected to recording devices.

Flow is measured or controlled at 9 places, liquid level at 20 and there are 15 spots for pressure relief.

All this totalizing of instrumentation doesn't mean too much. It is incomplete and inaccurate because it doesn't include water cooling, instrument air or catalyst preparation. It is only intended to give you, the reader, an idea of how carefully the whole project was planned. It indicates how Monsanto worked not only to get ease and economy of operation, but also to further the comfort, convenience and safety of operating personnel.

Thanks are due to the Monsanto men who were so helpful in the preparation of this article: R. K. Mueller, D. B. McCammond and especially J. S. Butler, supervisor of the fornaldehyde unit. We should tell you also that the photographs are the work of McGraw-Hill's Dick Wolters.

# Editorial Viewpoints

*SIDNEY D. KIRKPATRICK and Staff*

## More Light, Less Heat

Food and Drug Administration is initiating this month an extended proceeding from which it hopes to derive information of great importance to certain chemical industries. On it, FDA will ultimately set tolerances for residual poisonous or deleterious materials which are found on fruits or vegetables that have been treated with pest-control chemicals during growth in farm, orchard, or vineyard. This is a first, and very important, step toward a sound understanding of the program of pest control by agriculture. It is possible that substantial advantages can come from the proceedings. We all hope they will.

But there is also danger that considerable disadvantage may develop for all parties at interest. This is not at all inevitable. The conditions which would make for confusion or trade and technical complications can rather readily be controlled if self-discipline is practiced by all participants. Again we hope that such will be the case.

These proceedings have been called in good faith by government executives who plan to use them for constructive purposes. A vast majority of those who appear at the hearings will have comparable motives. It is sincerely to be wished that less understanding participants do not embark on tirades of criticism or anordered argumentative efforts. The proceeding can be and should be fact-finding in nature. Those who wish to submit arguments can do so later by brief. Controversy and wrangling at the hearing will be harmful to all, perhaps most of all to those who initiate such activity.

## Is More Ammonia Needed?

During most of last year, complaints were general that those who wanted to buy more nitrogen chemicals for fertilizer use were unable to secure adequate supplies in a form they could use for either direct application to the soil or for large-scale use in mixed fertilizers. This led a number of groups to the thought that they should build and operate their own ammonia facilities to insure supplies to meet their needs. Conspicuous among these groups was the Mississippi Chemical Corp., an enterprise organized and owned by a farmers cooperative in the State of Mississippi.

A year and more ago there may have been considerable justification for this project. There may then have been cause for feeling that groups like this would have to protect themselves with respect to raw-material supplies for fertilizer making. Now the situation is quite different.

There is at the present time clear evidence that the productive capacity for fertilizer nitrogen products exceeds the prospective demand for this year and for several years to come. This is fortunate because scarcity of fertilizer is a bad thing socially and economically. It seems a safe conclusion also that such groups as Mississippi Chemical should look again much more carefully at their own situations before adding further to the surplus productive capacity. It will not help that individual group, nor will it help the fertilizer industry as a whole, to have needless surpluses of either fertilizer materials or capacity to make them.

Naturally we are not acquainted with the details of the Mississippi Chemical proposal to borrow funds from the government in order to embark on their ammonia-making project. But we do feel that conclusions reached six months or a year ago demand very careful reappraisal now before large financial commitments should be made. Neither the agricultural economy nor the farmer cooperatives will be benefitted by costly duplication of existing facilities that can supply at reasonable prices all present and prospective needs for synthetic ammonia.

## Better Definitions Needed

Marketing of coal chemicals is still based largely on empirical names and specifications. Those acquainted with the business situation know the uncertainty that attaches to such terms as "creosote oil," "carbolic oil," and a dozen other groups of phenolics or tar-distillation products. The confusion which has resulted in a number of cases is unfortunate. Even in the case of wood-treating "creosote" one is not too sure what he is going to get even though deliveries conform rigorously with a trade specification.

It is not likely that this situation can be changed all at once. But steps for correction of present loose nomeclature and careless phrasing of specifications should be taken, vigorously and soon. It may not be feasible to go all the way in defining chemical names for many of the products other than benzene, toluene, xylene, naphthalene, anthracene, and a few others. But we do think that collaboration of tar processors and tar-products users in defining more

carefully the meaning of trade terms in common use is long overdue. American Coke and Coal Chemicals Institute has an unusual opportunity to take the lead in such a cooperative undertaking.

### Too Bad, It Isn't So

Chemical engineers will undoubtedly study with interest a recent Report of Investigations (No. 4534) of the U. S. Bureau of Mines which is entitled "Guide for Making Cost Estimates for Chemical Type Operations." This little mimeographed document is very suggestive because it spotlights in turn most of the major questions involved in pre-judging the probable cost for a new product of process industry.

Critical examination of the document, however, reveals a number of shortcomings. We note, for example, the suggestion that interest on capital investment "would appear . . . in the neighborhood of three to four percent." Estimates of interest on operating capital range from "five to eight percent." Similarly, "it is suggested that one percent per year on capital investment be used in estimating local, county and state taxes."

A little farther along in the report, "it is suggested that one-third to one-half percent of the total cost of the finished product be added to take care of research, experimental and developmental costs." And for distribution expense there is included general sales overhead, actual selling expense and traveling, operation of the shipping and packing departments "including salaries and wages, car maintenance, packaging supplies, shipping-room expenses, outgoing freight, express and drayage," and the cost of advertising of various kinds. For the total of these an allowance is suggested ranging from one-half to ten percent of the gross sales, with an average of five percent of the sales realization.

We wish that the bureau could tell us how chemical enterprises can keep these items within such a range. The profit millenium will have arrived, we believe, when no more than these suggested charges will serve for the purposes described.

It would be nice if these estimates could be taken at face value. We hope that inexperienced engineers using the report will not be deceived by them. One should limit the use of the report to suggestions of items that might otherwise be overlooked. For that purpose R. I. 4534 might prove very helpful.

### The Engineer and Society

Mott Souders, Jr., shared his sound philosophy of life with fellow chemical engineers last month in Pittsburgh. The occasion was his acceptance address on receiving the second AIChE professional progress award which is sponsored by the Celanese Corp. of America. Here is the way Dr. Souders sizes up the engineer's responsibilities to society:

"Over the last century the engineer has exerted a profound influence upon his physical environment. He appears to be equally well situated to influence his social environment. He has greater influence than he realizes; he has the confidence of the general public. His promises are fulfilled, his structures stand, his plants operate, his airplanes fly. His is a position of influence because the works he offers to society, unconfined by doctrine and dogma, are subject only to the pragmatic test: will they operate as promised?

"Moreover the engineer is a judge rather than an advocate. He has the habit of analyzing. He listens to partisans of this theory and that while always trying to face the facts. He is loath to align himself with either extreme in the struggles over social policies. Nevertheless the engineer works for things rather than against them. He is the builder of the new rather than the conservator of the old."

Having cited these qualifications of engineers as a group, Dr. Souders wisely concludes that the measure of their social effectiveness lies ultimately in the efforts of the individual engineer. Asked what the individual can do about it, the speaker suggests this program to his fellow chemical engineers:

"First, I think it behooves each of us to examine each important social issue in the same manner as we would an engineering proposal. What are the facts? What evidence supports the theories, however plausible? What can be done to test it on a small scale before applying it on a large scale? What will it cost and what will it produce? What are the byproducts and how will we handle them? What allowances are proposed for inevitable error? If it doesn't work, will the cost to society be excessive?

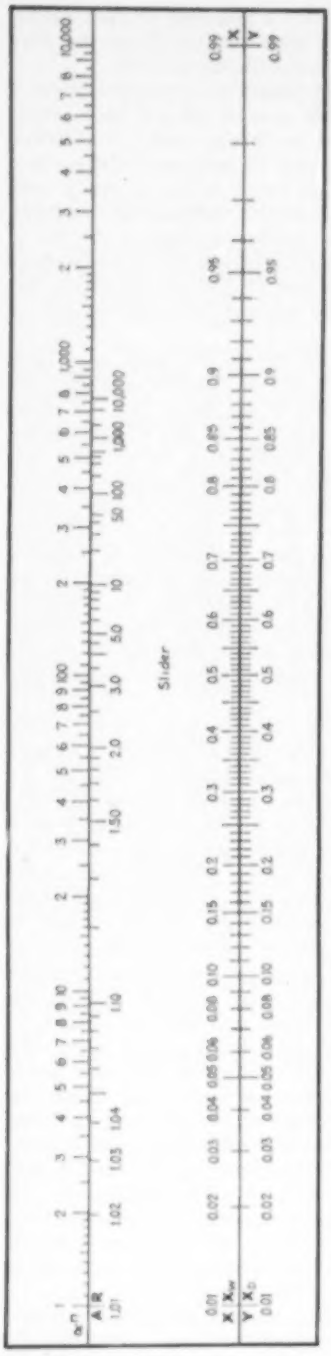
"Second, having arrived at our own considered opinion, we should make an effort, even at the sacrifice of some of our own time and comfort, to explain to others the basis of our judgment. We should speak before civic groups and write letters to the editor. Above all, we should discuss the issues with our neighbors and acquaintances whom we have in all walks of life. And we should listen honestly to those who hold contrary views so that we earn the courtesy of being heard in turn. As engineers we should naturally avoid dogmatism and emotion in presenting our side of the case, and show the willingness to compromise where compromise is essential to a working arrangement."

Here, then, is a working specification for applying the engineering method in the analysis and discussion of social problems. It is something each of us can do in our own community and in our own way.

# Slide Rule Speeds Up Distillation Calculations

**Although computations for distillation design are aided by nomographs, the special slide rule shown here is even easier to use**

**JU CHIN CHU, W. D. ROBINSON and D. P. DOLL**




**Scales for body and slider of a special slide rule for determining vapor-liquid equilibrium data and solving the Fenske equation.**

Vapor-liquid equilibrium relationships for binary systems can be represented by:

$$y = \frac{\alpha x}{1 + (\alpha - 1)x} \qquad (1)$$

As Eq. (1) was derived from the basic definition of relative volatility without any assumptions, it is applicable to non-ideal as well as ideal binary solutions.[1] In the case of an ideal solution, the relative volatility changes very little and can be assumed constant at an average value in most cases.

The calculation of the vapor-liquid equilibrium composition from Eq. (1) is important in the design calculation for distillation systems. Chu, Robinson and Doll[2] prepared a nomograph for Eq. (1) to save time in the multiple calculations needed in determining vapor-liquid equilibriums. The usual method of construction for nomographs has to be modified because of the recurrent variables $x$ and $y$ in the Eq. (1), which makes the modulus not constant. As $x$ or $y$ is varied to unity, the moduli of their scales approach infinity; on the other hand, the moduli become indeterminate as x or y equals zero.

In the construction of nomographs, logarithmic scales must be used. A similar method was used in the construction of the slide rule discussed here. The dynamic nature of a slide rule makes it more useful and applicable than a nomograph. Four-cycle, 10-in. logarithmic paper was used in laying out the x, y, and $\alpha$ scales as illustrated in the accompanying diagram. To use this slide rule, the reference line $R$ (which is the left-hand index of the upper slide scale) is set on a given value of $\alpha$. The equilibrium value of y is read directly below any given value of $x$.

The slide rule presents a distinct advantage over the nomograph in the construction of an equilibrium curve. Once the reference line is set on a given value of $\alpha$, the equilibrium values of $x$ and y can be read over the entire ranges of values from 0.01 to 0.99. In using the nomograph, a straight edge must be moved each time a different value of $x$-$y$ is to be determined.

The same slide rule can also be used in making tray-to-tray calculations of the liquid and vapor concentration on each tray at total reflux. Set the reference line on the given value of $\alpha$. Start with the composition of the liquid from the reboiler on the $x$-scale and read the equilibrium composition of vapor from the y-scale. Since the composition of the vapor from the reboiler is the same as that of liquid from the first bottom plate, the latter value is set with the cursor on the $x$-scale and the composition of the equilibrium vapor can be read directly below on the y-scale.

By the construction of one additional scale on the rule, it is possible to solve Fenske's equation directly. The Fenske equation for binary systems is represented by:[4]

$$n = \frac{\log \dfrac{x_D\,(1 - x_w)}{x_w\,(1 - x_D)}}{\log \alpha} \qquad (2)$$

Take logarithms of Eq. (2), it becomes:

$$\log n = \log\left(\log \frac{x_D}{1 - x_D} - \log \frac{x_w}{1 - x_w}\right) - \log \log \alpha$$

Since the terms

$$\log x_D/(1 - x_D)$$

and

$$\log x_w/(1 - x_w)$$

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have already been included in the x and y-scales respectively, it is only necessary to transfer their difference to a log-log scale from which a scale of log-log $\alpha$ can be subtracted to give the value of $n$ opposite the index.

The major problem involved in interpreting the Fenske equation on the slide rule was in laying out the log-log scale A. The scale was laid out with the aid of the log-log scale on a standard log-log slide rule. Although this does not take advantage of the full length of the rule, it was found that the length of the scale could be increased at the lower range by using a smaller base. However, the size of the scale was already large and the extension in the high range of values was only slight.

### AN EXAMPLE OF USE

The procedure for using the slide rule to solve Fenske's equation for the number of theoretical plates at total reflux follows the steps illustrated below. As an example, let $x_D = 0.90$, $x_w = 0.10$ and $\alpha = 1.5$. Then:

1. Set the value of $x_w = 0.10$ on the x-scale directly above the value of $x_D = 0.90$ on the y-scale.
2. Set the cursor on the reference line $R$ and note the value of $\alpha^n = 81$ on the $\alpha$-scale.
3. Reset the reference line $R$ to $\alpha = 1$, and on the A-scale set the cursor at the value of $\alpha^n = 81$ obtained in Step (2).
4. Leaving the cursor in place, set the A-scale under the cursor to the value of $\alpha = 1.5$ of the system, as given in the problem.
5. Read the number of theoretical plates $= 10.8$ on the $\alpha$ scale. This number, of course, includes the reboiler as one theoretical plate.

The actual calculation from Fenske's equation gives $n = 10.8$, the same value obtained by the slide rue in a fraction of time involved in the actual calculation.

### NOMENCLATURE

- $n$ —Number of theoretical plates in the column, plus one.
- $x_D$—Mol fraction of the low boiling constituent in the overhead product of a distilling column.
- $x_w$—Mol fraction of the low boiling constituent of the liquid from the reboiler.
- $x$ —Mol fraction of the low boiling constituent in the liquid from any plate.
- $y$ —Mol fraction of the low boiling constituent in the vapor in equilibrium with the liquid of the composition $x$.
- $\alpha$ —Relative volatility.

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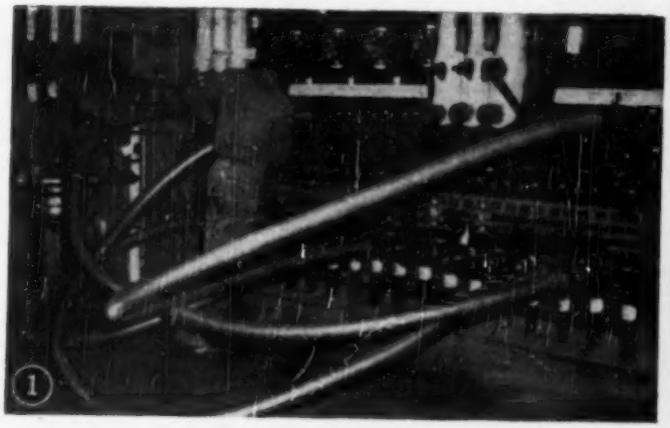
2. Chu, J. C., Robinson, W. D., and Doll, D. P., *Chem. Ind.*, to be published during 1950.
3. Fenske, M. R., *Ind. Eng. Chem.*, **24**, 482 (1932).

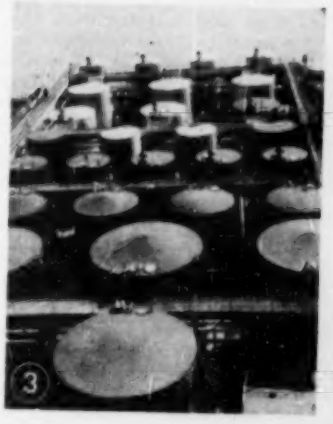



## Plug in for Liquid Handling

Many novel ideas in handling process liquids have been incorporated in the new resin plant of U. S. Industrial Chemicals, at Newark, N. J. This plant makes a wide variety of products classified as alkyd and maleic resins, ester gums, and modified phenolics. Since most of the raw materials and finished products are handled as liquids, a versatile liquid handling system is essential.

Perhaps the most novel scheme is the "snake pit" shown in Fig. 1. This is a liquid "switchboard" served by flexible metal hose which can be used to interconnect any pair of many pipes leading to and from various pieces of equipment. Located in the filter press room, its main function is to lead the filtered products of the 6,000-gal. reaction kettles to storage tanks, but it also enables the operator to connect to other equipment or to the tank farm in Fig. 3.

Another ingenious scheme appears in Fig. 2. Tanks in the tank farm for storing solvents and other materials are piped to manifolds near the reactors. The operator selects the desired material and starts its pump with the proper selector switch. The material is then metered into the reactor and the pump shuts down automatically when the correct quantity has entered.



# Pressure Drop Through Fixed and Fluidized Beds—A Nomogram

**Nomogram helps figure pressure drop when liquid or gas flows through bed of granular material. Important in absorption towers, catalytic reactors, filters**

MURRAY WEINTRAUB and MAX LEVA

The pressure drop in gases and liquids flowing through beds of granular material is an important factor in the engineering of absorption towers,[4] catalytic reactors,[2] and filters.[1] Recent investigations into the fundamentals of fluidization of solids[3,5,6] have shown the intimate relation between pressure drop and fluidization phenomena. It has been established that, if upward flow of a fluid through a bed of granular material is gradually increased, the solids will begin to fluidize when the pressure drop across the bed equals the buoyant weight of the solids. The utility of this relationship will be demonstrated in Illustrative Problems 2 and 3.

### CORRELATIONS

As in most fluid flow work, it is convenient to divide the subject into three sections, according to whether the flow is turbulent, laminar, or transitional. For flow through granular solids, laminar flow exists at a modified Reynolds number[3] $D_p u \rho_f / \mu < 10$; the range between 10 and 200 may be considered as transitional, whereas above 200 the flow is predominantly turbulent. The turbulent range has been covered by many investigators; the most recent correlation has been expressed as a nomogram.[7]

Laminar flow is, however, as important as turbulent flow since many industrial catalytic processes, including most fluidization operations, fall into this range. The important variables have been correlated[3] satisfactorily by:

$$\Delta p = \frac{200\, G \mu\, L\, (1-\epsilon)^2}{g\, D_p^2\, \rho_f\, \epsilon^3\, \phi_s^2} \qquad (1)$$

This equation is supported by data that pertain to flow of air, helium, carbon dioxide, and other gases through beds of particles, ranging in size and shape from 0.252-in. Raschig rings to sands of 0.00202-in. diameter; it can also be verified by data of other investigators using water (e.g., Illustrative Problem 2). It is valid for fixed beds and also for fluidized systems if $\epsilon$ is taken as the voidage at which fluidization begins.

### HOW TO USE NOMOGRAM

The nomogram, Fig. 1, was constructed from Eq. 1 after changing the dimensionally consistent units of the equation to the more common engineering units specified in the figure. The use of Fig. 1 is simple: after the evaluation of the necessary system properties it is necessary only to determine upon which axis the unknown value will be found and then to follow the order given in the key of the figure to arrive at that axis as the last point.

It may be noted that the shape factor, $\phi_s$, can either be evaluated from the geometry of the particle or estimated, when small irregular particles are involved, by visual comparison of the particle with photographs of particles of known shape factor, a few of which have been published.[6] It may also be noted, from the definitions of $\phi_s$ and $D_p$, that the value of $\phi_s D_p$ is simply 6 V/A. Evaluation of the fractional voids, $\epsilon$, is most precisely done by actual measurement by liquid displacement; but, where the particles are not available to the designer, or where they would absorb a portion of the liquid, it may be necessary to resort to previously published correlations,[3,6] which are summarized here

### NOMENCLATURE

- $A$ — Surface area of particle (sq. ft.).
- $D_p$ — Diameter of sphere of volume equal to particle = $(6\ V/\pi)^{1/3}$ (ft.).
- $f$ — Friction factor.
- $g_c$ — Gravitational acceleration (ft./hr, hr.).
- $G$ — Superficial mass velocity of fluid. (lb./hr. sq. ft.).
- $L$ — Length of packed section of reactor (ft.).
- $N_{Re}$ — Reynolds number (no dimensions).
- $t$ — Temperature (deg. C.).
- $u$ — Superficial linear velocity of gas (ft./hr.).
- $V$ — Volume of particle (cu. ft.).
- $X, Y$ — Arbitrary constant (no dimensions).
- $\epsilon$ — Fraction (void space)/(total packed space).
- $\phi_s$ — Shape factor = (area of equivalent volume sphere)/(area of particle) = $\pi^{1/3} (6\ V)^{2/3}/A$.
- $\mu$ — Gas viscosity (lb./ft. hr.).
- $\rho_f$ — Gas density (lb./cu. ft.).

MURRAY WEINTRAUB and MAX LEVA are chemical engineers doing research and development work on synthetic fuels for the Bureau of Mines at Bruceton, Pa. For finished drawings and for editorial assistance they wish publicly to thank two co-workers, C. R. Siple and Milton Grummer.

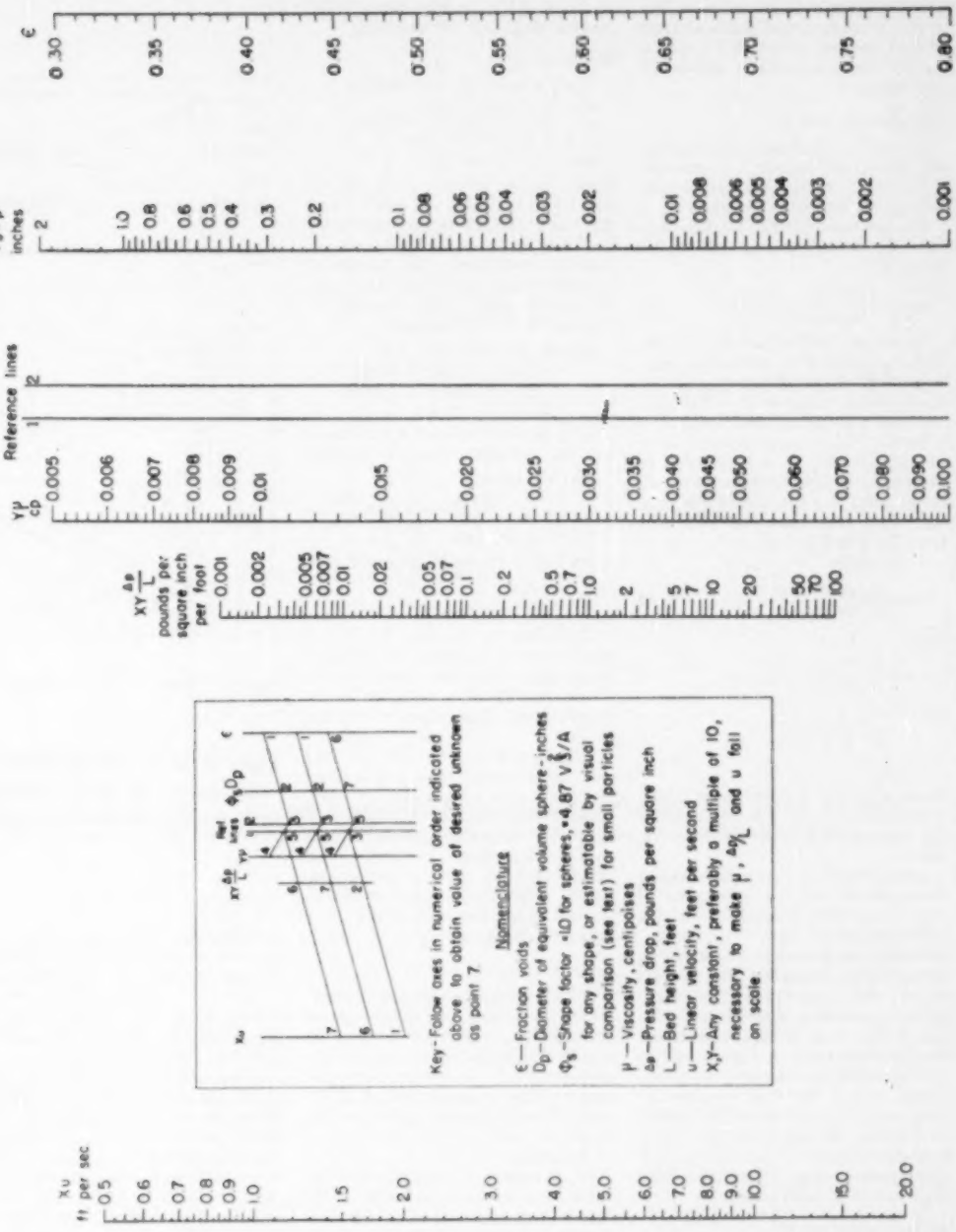



**Fig. 1—For the streamline range. Correlates pressure drop with fluid velocity, fluid viscosity, size and shape of packing particles, void space in the bed.**

as Figs. 2 and 3. In case the particle diameter is the unknown value sought, the nomogram is of special value, because it permits a rapid trial and error solution to find values of $D_p$ and $\epsilon$ that are consistent with an established relationship.

### TRANSITIONAL RANGE

In order to facilitate pressure-drop calculations still further, it is desirable to be able to extend the calculations through the transitional range.

The general equation for the pressure drop through packed beds can be stated as:

$$\Delta p = \frac{2 f G^2 L (1-\epsilon)^{(2-n)}}{D_p g_c \rho \rho \epsilon^3 \phi_s^{(2-n)}} \qquad (2)$$

Values of $f$ and $n$ have been represented graphically[5] as continuous functions of the Reynolds number. Eq. 1 results when values of $f = 100/N_{Re}$ and $n = 1$ are substituted in Eq. 2.

Because Eq. 1 is, algebraically, much simpler than Eq. 2, it is desirable to express the pressure drop in the transitional range as a function of the pressure drop that could be calculated from Eq. 1 or Fig. 1.

If we define

$$C = \frac{\Delta p \text{ calc. from Eq. 2}}{\Delta p \text{ calc. from Eq. 1}} \qquad (3)$$

then

$$C = \frac{2 f G^2 L (1-\epsilon)^{2-n}}{D_p g_c \rho \rho \epsilon^3 \phi_s^{2-n}} \times \frac{D_p g_c \rho \rho \epsilon^3 \phi_s^2}{2 f' G^2 L (1-\epsilon)^2}$$

$$C = \phi_s^{n-1} (1-\epsilon)^{1-n} f/f' \qquad (4)$$

where $f'$ is the friction factor which would be obtained by extrapolation of the laminar section of the $f$ vs $N_{Re}$ curve.

Since $n$ and $f/f'$ are each complex functions of $N_{Re}$, the nomogram of Fig. 4 has been constructed for the evaluation of C.

Briefly, the procedure for estimating pressure drop in packed beds consists of (1) determination of the various system properties, possibly with the aid of Figs. 2 or 3, and calculation of the Reynolds number, (2) use of Fig. 1 to calculate the pressure drop which would exist if the flow were streamline, and (3) if the Reynolds number is between 10 and 200, use of Fig. 4 to determine a value of C by which the pressure drop determined from Fig. 1 is to be multiplied.

### SAMPLE PROBLEM NO. 1

A catalyst in the form of $\frac{1}{8} \times \frac{1}{8}$ in. cylindrical pellets is to be reduced in a stream of hydrogen at 450 deg. C., 1 atm. pressure, and 1,000 space velocity (1,000 cu. ft. of gas at 0 deg. C. and 1 atm. per cu. ft. of packed reactor volume). The reactor consists of a bank of 6-ft. by 3-in. tubes. What pressure drop may be expected?

*Solution:—*

$V_p = \frac{1}{8} \times \pi/4 \times (\frac{1}{8})^2 = 0.00153$ cu. in.

$A = [2 \times (\pi/4) \times (\frac{1}{8})^2] + [(\frac{1}{8}) \times (\pi) (\frac{1}{8})] = 0.0736$ sq. in.

$D_p = (6\ V/\pi)^{1/3} = 0.143$ in.

$\phi_s D_p = 6\ V/A = 0.125$ in.

Space velocity reduced to 0 deg. C. and 1 atm. is 1,000. In a 6-ft. tube, the linear velocity would, therefore, be 6,000 ft./hr., or 1.67 ft./sec., at standard conditions. Gas density at standard conditions is 0.00557 lb./cu. ft. At 450 deg. C., the viscosity of hydrogen is 0.0160 centipoise.

$$\text{Reynolds numbers} = D_p u_o \rho_o / \mu = \frac{(0.143) \times (1.67) \times (0.0057)}{(12) \times (0.0160) \times (0.000670)} = 10.3$$

This is just in the range where Eq. 1 and the nomogram may be applied.

$\phi_s D_p = 0.125$ in.

$$u = u_o \times \frac{273 + t}{273} = 1.67 \times \frac{723}{273} = 4.42 \text{ ft./sec.}$$

From Fig. 3, it may be estimated that

$\epsilon = 0.34$

$\mu = 0.016$ centipoise

Reference to the key in Fig. 1 shows that, to determine the value of the pressure drop, the various points should be aligned as indicated in the middle series of numbers of the key in Fig. 1.

Align $\epsilon = 0.34$ with $\phi_s D_p = 0.125$ and continue to reference line 2. From this point, draw a line to $Y_\mu = 0.0160$. Connect the point of intersection of this latter line and reference line 1 to $Xu = 4.42$ ft./sec. and read a value of $XY\Delta p/L$ of 0.21 lb. per sq. in. per ft. Since for this problem X and Y were each taken as 1, $\Delta p = 6 \times 0.21 = 1.26$ lb./sq. in.

### SAMPLE PROBLEM NO. 2

What is the maximum velocity with which water can be passed upward through a bed of worn sand of diameter 0.0219 in. before the bed begins to expand? By measurement, the initial voidage is found to be 40.8 percent. The pycnometric density of the sand was 2.639 g./cc.

*Solution:—*

As it is necessary to assign a shape factor to the sand, use is made of the information on page 518 of Reference 3 where a typical worn sand was found to have a value of $\lambda$ equal to 1.16, or $\phi_s$ of 0.862.

The bed will expand when the pressure drop per unit length will equal the buoyant weight of the bed per unit length. This latter value is the product of buoyant density and solid volume per unit reactor volume, or $(2.639 - 1.00)\ (62.4)\ [(1 - 0.408)/1] = 60.4$ lb. per sq. ft. per foot of length. $\Delta p/L = 60.4/144 = 0.419$ lb. per sq. in. per foot.

To obtain the value of linear velocity as the answer on the nomogram, follow the top order of the key: $\epsilon = 0.408$, $\phi_s D_p = 0.0189 \rightarrow$ reference line 2; reference line 2, $Y_\mu = 0.01 \rightarrow$ reference line 1; reference line 1, $XY\ \Delta p/L = 0.419 \rightarrow Xu = 0.70$.

Since a value of $Y = 0.01$ was assumed to keep $Y\mu$ on scale and since XY was assumed equal to 1, $X = 100$, whence $u = 0.0070$ ft./sec.

In their "Table 3," Wilhelm and Kwauk[6] observed that a sand bed of this particle diameter expanded under

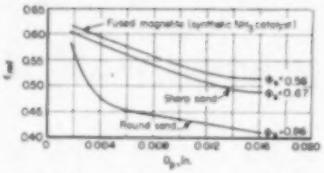



Fig. 2—Min. fluidized voidage, fine particles.

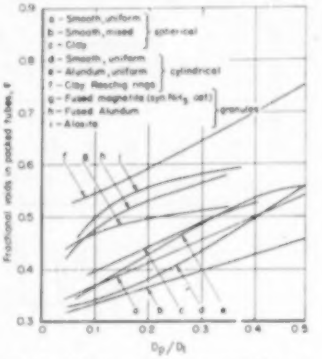



Fig. 3—Voidage of larger particles in packed beds.

**Figs. 2, 3 — Help estimate void space in bed; voidage must be known to work Fig. 1**

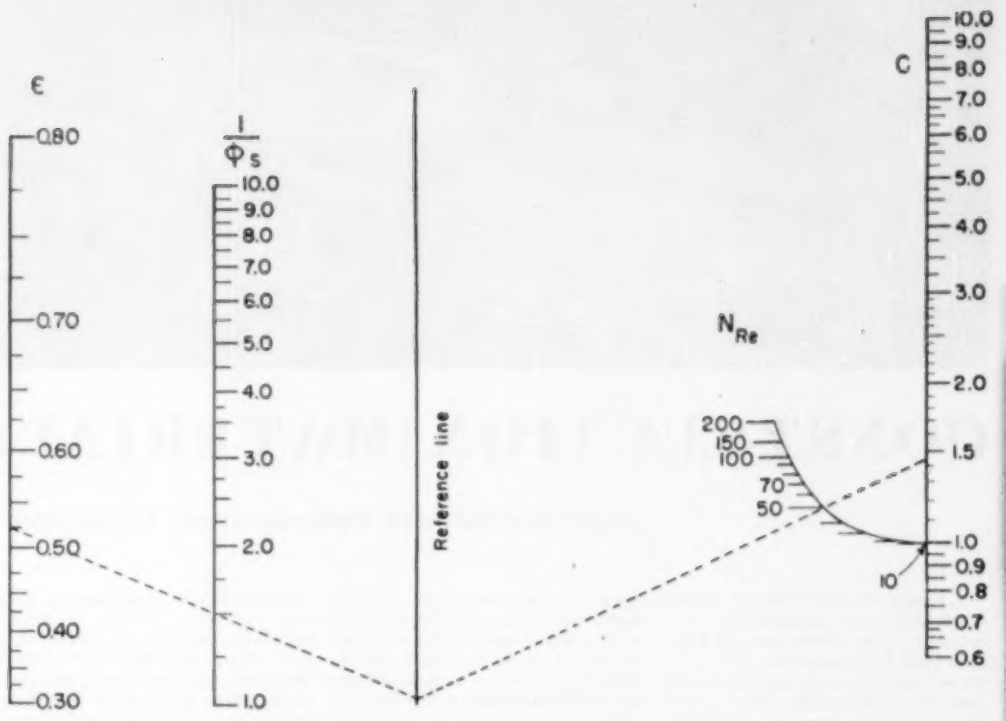



**Fig. 4—Extends Fig. 1 through transitional range; gives a factor, $C$, by which to multiply pressure drop obtained from Fig. 1, thus correcting for non-streamline flow.**

an upward flow of water of 0.0069 to 0.0080 ft./sec.

SAMPLE PROBLEM NO. 3

It is desired to carry out a given reaction with a fluidized magnetite catalyst at a space velocity of 250. The reactor is 1 ft. in diameter and is to be filled with catalyst to a height of 1 ft. It is desired to determine the diameter of the particle which will just begin to fluidize at one-half the space velocity of operation.

Visual comparison of samples of the material with the photographs of pages 513, 514, and 707 of Reference 3 reveals that the material is identical in shape with that designated as $\lambda = 1.73$, or $\phi_s = 0.578$.

The gas viscosity at operating conditions is estimated as 0.018 centipoise. The specific gravity of magnetite is 5.00.

*Solution:*—

$u = \frac{1}{4}(250)/(1 \times 3{,}600) = 0.0347$ ft./sec.; so letting $X = 100$, $Xu = 3.47$.

Given, $\mu = 0.018$, and letting $Y = 1.0$, $Y\mu = 0.018$.

Assume a voidage of 0.52. Pressure drop for fluidization is then: $\Delta p/L = (5.00)\ (62.4)\ (1 - 0.52)/(144) = 1.040$ lb./sq. in. per ft.; and since $XY = 100$. $XY\Delta p/L = 104.0$.

Following the bottom order of the key, the first approximation gives a value of $\phi_s D_p = 0.0020$ in. or $D_p = 0.00346$ in. Fig. 2 shows that such a small particle would be expected to yield a voidage of about 60 percent. For such a voidage: $\Delta p/L = (5.00)\ (62.4)\ (1 - 0.60)/144 = 0.866$ lb./sq. in. per ft.; and $XY\Delta p/L = 86.6$.

Repeating the nomographic calculation, $\phi_s D_p$ is found to be 0.0015 in. and $D_p = 0.0026$ in. This size particle should have a voidage of about 61 percent, which is as close to the last assumption of 60 percent as the curves permits.

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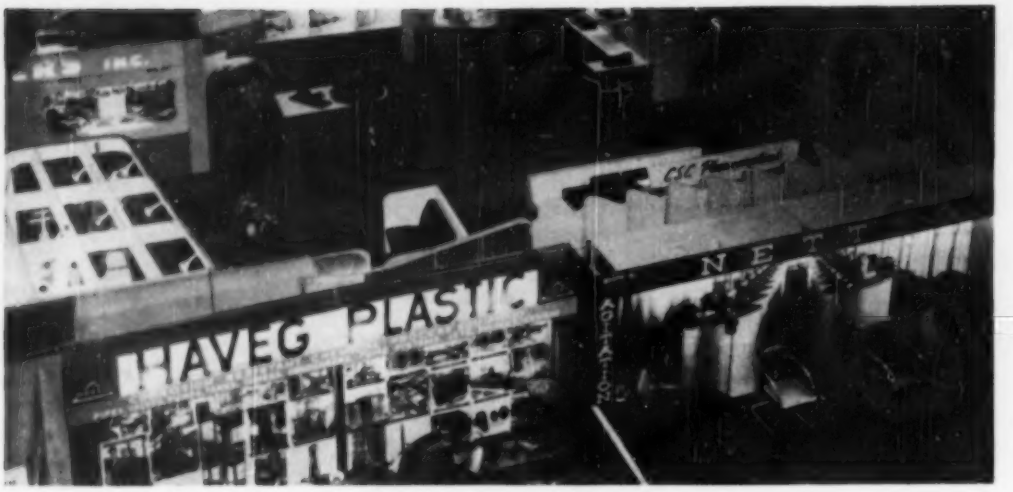



# CONSTRUCTION MATERIALS

**Bigger than the "New Equipment Story" was the story of**

Although at past Chemical Shows developments in equipment have ordinarily been much more striking than those in construction materials, the reverse was true in the 22nd New York Show last month. There were, of course, many pieces of equipment that were being displayed for the first time, but most of them had previously been dealt with in print, in new equipment pages, or in our surveys of equipment trends (May 1948 and November 1949).

There are four main areas in construction materials where the most interesting advances seem to lie: in plastics, ceramics, alloys, and finally, in the new hybrid metal-ceramics. For an over-all general impression, the trend toward diversification is accelerating, with more and more materials, in greater and greater variety, appearing for use under severe conditions of temperature, corrosion or stress. Chemical engineers are thus presented with new opportunities for prolonging equipment life, decreasing product contamination, or meeting conditions for which suitable materials were not even to be had a few years ago.

### PLASTIC PROGRESS

It is impossible to avoid the impression that Teflon, Du Pont's almost universally resistant plastic, is still the biggest news in construction materials despite its extensive publicity in the last two or three years. Teflon lining (for which see E. C. Fetter, *Chem. Eng.*, Nov. 1949, p. 120) made its first public appearance in the form of a lined ejector, shown by Schutte & Koerting, and a few flat coated panels exhibited by Knapp Mills. The last named also showed samples of the primer and finish materials used for Teflon coating. Both exhibitors emphasized, as does Du Pont, that full-scale commercialization of the process is still in the future, although S & K hopes to have lined ejectors in commercial service shortly.

Sheet and other solid Teflon forms were also much in evidence, as would be expected from the large extent to which the plastic has been applied to pump and valve packings, gaskets, and mechanical shaft seals in recent months. National Carbon showed a new Karbate centrifugal pump with a seal based on Teflon. Packings of this material were exhibited by Power Products Co. A large number of Teflon details were featured by the Pfaudler Co., including gaskets of several types, and an all-Teflon expansion joint. Proportioneers is now offering a proportioning pump having a Kel-F diaphragm and Teflon-faced valves.

Other plastic developments were also numerous. Glass-plastic combinations are now being used extensively, with all of the chemical stoneware manufacturers featuring glass-reinforced plastic linings, and Knight offering fume ducts of this type. All, too, were showing a new method of armoring for stoneware, porcelain or silica parts such as pipe, valves and fittings. This method consists in wrapping with glass tape which is then painted with a plastic coating. Several layers can quickly be applied, even in the field. The procedure looks as if it might all but displace the metal armoring used in the past.

Hills-McCanna now is offering a Saunders type valve with a polyethylene diaphragm for sulphuric acid service. Worthington is building a new Haveg centrifugal pump with a Haveg mechanical seal. U. S. Stoneware is currently able to supply 2-in. Tygon tubing, where 1-in. was formerly the largest size; as well as the new Tygon K maintenance paint which requires no primer or special surface preparation. The same concern showed vinyl plastic gaskets reinforced with nylon. Other synthetic fibers too were more in evidence as filter fabrics than in the past, with Du Pont's Orlon now added to the list. The Day Co. is already experimenting with synthetics for the

# AT 1949 CHEMICAL SHOW

**new materials of construction at the 22nd "Chem Show."**

felt bags used in its blow-back type dust filters.

WHITHER CERAMICS?

Perhaps it does not mark a definite trend, but it seems significant that within the last two years a preponderance of the chemical stoneware industry has gone all out for porcelain. Both General Ceramics and U. S. Stoneware are now offering full lines of high-fired chemical porcelain. The first, in fact, showed a 750-gal. porcelain vessel which is said to be the largest every produced in a single piece —8 ft. high by 4 ft. in diameter. Both are now producing standard lines of pipe, valves, fittings and vessels, as well as made-to-order equipment of other types. Both are offering porcelain electrolytic diaphragms. Although the volume of chemical stoneware produced is still much greater than that of porcelain, the newer material is creeping up. It will be interesting to see how far its appearance advantage will be able to overcome its price differential in the competition that is ahead.

METAL TRENDS

New alloys were not numerous at the Show, although there was much evidence of further expansion of the older types. Stainless alloys become ever more important. A valve maker was showing small valves with precision-cast stainless bodies, largely eliminating machining. More and more stainless is going into piping, valves, and vessels, and now into small drums to replace carboys, as in those shown by Pressed Steel Tank Co. A new alloy steel designated by Lebanon Steel Foundry as its No. 22, was first announced at the Show for service from −423 to +1,150 deg. F. This austenitic casting alloy of 19.5 Cr, 9 Ni type is pointed both toward liquid oxygen and jet engine applications.

Also of much interest for extreme temperatures is the new Inconel X, put on view for the first time by International Nickel. This alloy, essentially a 15 Cr, 18 Ni type, with hardening alloy elements, retains a good degree of strength at 1,550 deg. F., its rupture stress being 18,000 psi. at 1,500 deg. F. Made in all mill forms, the alloy may prove important in gas turbine and jet engine applications, as well as in high-temperature process equipment.

Still in the development stage is a new helium-shielded welding process for tantalum, shown by Fansteel. Welds are strong and ductile and can be drawn without injuring the joint. They can be rolled to the point of disappearance.

METAL-CERAMIC CROSSBREED

Metal-ceramics or cermets, still a virtually unknown breed of construction materials for which tremendous possibilities may be in the offing, were shown by Haynes Stellite Co. Known as Metamic Types LT-1 and LT-2, these crossbreeds of metal and pure oxide ceramics have properties intermediate between those of the parents, and different from those of either. They are generally produced by powder metallurgy methods and have better thermal conductivity and thermal shock resistance than ceramics, coupled with better oxidation resistance and lower solubility in molten metals than metallic species. At the present still experimental stage, the size limit that can be produced is 2 in. diameter, or 18 in. in length.

These materials are dull gray or black as produced, but metallic in appearance after grinding or machining. They are relatively strong, even at high temperatures, but brittle and rather sensitive to thermal shock. Below 1,000 deg. C. Type LT-2 is better for long-time stress, but above that temperature, LT-1 is superior because of its better oxidation resistance. Type LT-2 especially retains its strength at temperatures in the 1,800 to 2,500 deg. F. range, while LT-1 resists air oxidation to 2,200 deg. F.

**Viscosity of many liquids depends on how fast they're sheared—a point engineers may forget sometimes. Result: wrong pumps and red faces. To pick the right pump . .**

# Measure Viscosity at Pumping Velocity

**A. M. SHAW**

For many years, engineers have computed the size and speed of pumps, the pipe friction losses in systems and the power required to move liquids, based on the behavior, first discovered by Sir Isaac Newton, of "true liquids" such as water and mineral oils. The fundamental rules, thus established, have been applied to many other common liquids, often resulting in inexplicable performance, embarrassment to the application engineer and inaccurate selection of pumping equipment. To clarify these mysteries, we must study the behavior of various liquids in motion.

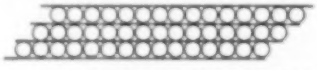
*Fundamental Principles* — The trouble starts with the original concept of viscosity $\mu$ which is that property of a liquid that resists flow at any velocity however small. If we place a film of mineral oil between two parallel plates and move the top plate at constant velocity, thus . . .

*Sir Isaac laid a booby trap*

. . . each layer of oil particles moves with a velocity directly proportional to its distance from the stationary plate. The so called rate of shear is the velocity of the upper plate V divided by distance *d*. The rate of shear is the same for every layer of particles. The shear stress is the force *F* divided by the wetted are *A* of the moving plate.

Sir Isaac Newton's fundamental principles of laminar flow postulate that: (1) Shear stress $F/A$ is uniform in all parts of the film; (2) shear stress is directly proportional to the viscosity $\mu$; (3) viscosity is constant regardless of the rate of shear. These quantities are related as follows: Viscosity $\mu$ = (shear stress) ÷ (rate of shear) = $(F/A) \div (V/d)$. This velocity $\mu$, which is a factor of proportionality between the shear stress and rate of shear, is sometimes termed absolute viscosity to differentiate it from the more common kinematic viscosity (= absolute viscosity/specific gravity).

Let us consider each particle of the oil as spherical in shape like small balls rolling between flat plates . . .

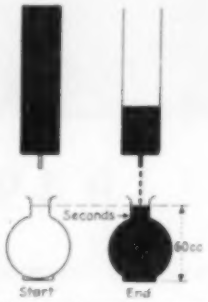


*Only true liquids follow the rules*

. . . If we move the top plate at constant velocity the stress is uniformly transmitted through each layer and the frictional resistance of the balls would be constant. The rate of shear of each layer of balls is the same as for all other layers. The rate of shear of all layers will vary in direct proportion to changes in stress which vary the velocity.

*Fallacy of Present Methods*—The catch in Newton's hypothesis is that it applies to "true liquids" that are chemically pure and physically homogeneousus. A large portion of the viscous liquids pumped change their viscosity radically as the rate of shear or velocity of flow increases.

**Efflux** viscosimeters like the Saybolt Universal, shown here diagrammatically . . .




*Saybolt may be wrong; it's static*

. . . will not detect such characteristics because they indicate only one period of time required to pass a given quantity of liquid through a pipette or aperture. They will disclose the kinematic viscosity of the liquid in an almost quiescent state, but that may not be the viscosity of the liquid as it passes through the pumping system.

*Thixotropic Liquids*—All liquids which reduce their viscosities as the rate of shear increases are termed thixotropic. Somewhere within their viscosity-temperature range the following liquids are in this class.

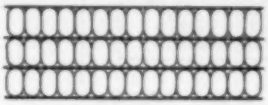
| | |
|---|---|
| Adhesives | Molasses |
| Animal oils | Paints |
| Asphalts | Paper size |
| Bentonite | Plastics |
| Cellulose compounds | Printing ink |
| Corn sirups | Rayons |
| Fish oils | Resins |
| Fruit juice concentrates | Soaps |
| Glues | Starches |
| Greases | Sugar sirups |
| Lacquers | Tars |
| Lard | Varnishes |
| Latex | Vegetable oils, shortenings |
| | Waxes |

This performance is not confined to highly viscous liquids. It is present in many liquids of low viscosity but one cannot so easily perceive what is taking place.

Many highly technical or mathematical explanations of the behavior of thixotropic liquids have been given.

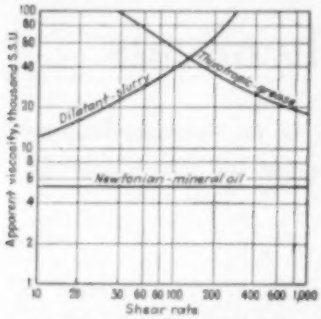
A. M. SHAW won a *prize with this article in a recent contest sponsored by the Hydraulic Institute. Pump selection is his forte; he is an application engineer with* Worthington Pump & Machinery Corp., *Harrison, N. J.*

The simplest hypothesis is that the particles are elongated or capsule shaped . . .



Some liquids are hard to get started

. . . as compared with the spherical particles in Newtonian liquids. The elongated particles have a tendency to stand up and obstruct the movement of the liquid. As agitation is increased the elongated particles tend to lie down and turn like a roll or become more and more spherical. In either case, the resistance to flow is diminished and a reduction in viscosity is apparent. Like the grease shown here . . .




Viscosity's ups and downs must be detected

. . . a high initial stress is necessary to create motion or shear; the rate of shear is not directly proportional to the shear stress; viscosity is not constant; and therefore such liquids do not conform to Newton's findings.

Most thixotropic liquids will return to the original viscosity if left in a quiescent state for sufficient time. The rate of recovery varies with each liquid. Some liquids will revert to their original viscosity almost immediately while others will recover after several hours.

Knowledge of this phenomenon is used to advantage in pumping chilled lard, vegetable shortening and greases which in normal state will not flow. Agitation sufficient to cause flow to the pump through a short and direct pipeline is necessary. The liquid must not be allowed to flow at low velocity or it may go over to its original state. A high suction head with large pipe may result in a grease solidifying before it reaches the pump.

The apparent viscosity of thixotropic liquids will ultimately approach the viscosity of the solvent or carrier liquid with which it may be compounded. If the grease shown in the graph is agitated at high speed, its viscosity will approach the viscosity of a mineral oil, and similarly the viscosity of a corn sirup will ultimately approach the viscosity of water.

*Colloidal Liquids* — Some compounded liquids are of a colloidal nature and act like thixotropic liquids but will not recover their original viscosity when movement stops. The colloidal structure is altered and the pump man must select equipment which imparts low velocities not capable of altering the nature of the liquid. Colloidal solutions of soaps in water or oils at low viscosities are common. Lotions, shampoos, many pharmaceutical preparations, gelatinous compounds and the like are in this class.

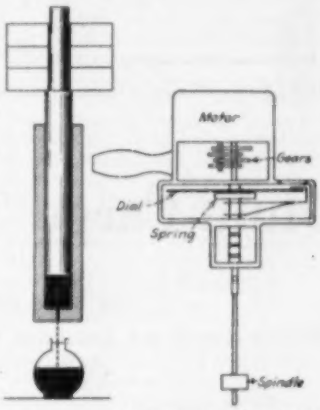
*Dilatant Liquids*—If the viscosity of a liquid increases as agitation or rate of shear increases the liquid is classified as dilatant (see graph). It is the opposite of thixotropic. Heavily filled liquids such as clay slurries, candy compounds, milk chocolate filled with buttermilk powders, some starches and paints, quartz sand in water or carbon tetrachloride are, within a narrow range of concentration, dilatant. Most dilatant liquids will quickly return to their original viscosity as soon as agitation ceases. It is important to avoid the dilatant range because an increase in viscosity means increased pipe frictional head, an overloaded driver, and possibly a clogged pump.

Some liquids may change from thixotropic to dilatant or vice versa as the temperature or concentration is varied. These phenomena occur principally within the laminar range of flow. Most liquids in these classes will approach the characteristics of Newtonian liquids when the flow becomes turbulent.

*Recommendations*—It is apparent that more accurate determinations of viscosity must be made under pumping conditions. No longer can we depend upon viscosity ratings determined by efflux viscosimeters in laboratories remote from the pump installation because: Such viscosimeters do not detect thixotropic or dilatant characteristics; it is difficult to duplicate in the laboratory the rate of shear of the liquid as pumped; the viscosity of the sample may change in transit, in reheating or in reworking; the sample may recover its original viscosity before a lab test can be made.

To obtain an accurate indication of the viscosity of liquids under pumping conditions, the viscosity test should be conducted at the pumping station, preferably with samples taken from the stream leading to the suction and from the discharge of the pump. Such tests should be conducted before the viscosity of the liquid has time to recover. A viscosimeter, capable of quick determinations using at least two speeds, will detect thixotropic or dilatant tendencies and give accurate indications of the viscosity of the liquid within the system.

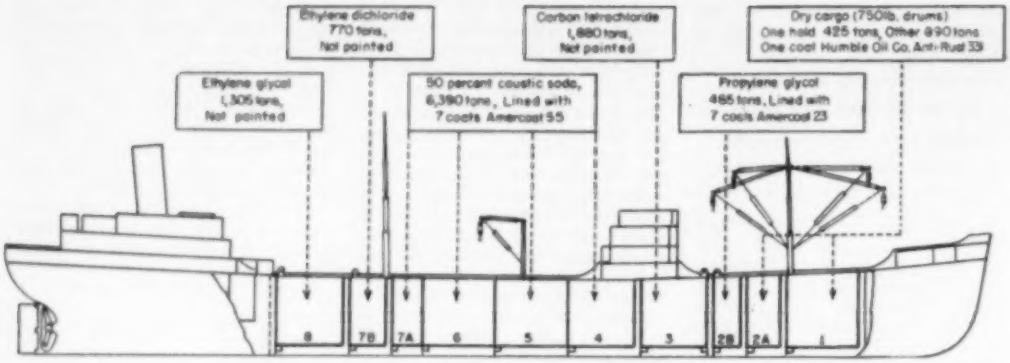
If the liquid has a slow rate of recovery, a sample may be placed in a pressure type viscosimeter, as shown here on the left. . .




True meters for untrue liquids

. . . and different pressures exerted to force the liquid through the pipette at different rates of shear approximating the calculated rate at the suction opening to the pump. The viscosimeter on the right is a torsional type. It has a constant speed motor with reduction gearing to provide four speeds on any of a variety of spindles. The drag of the liquid on the rotating spindle is transmitted in tension through the calibrated spiral spring and recorded on the dial at the top. The instrument gives quick viscosity readings at different spindle speeds, detecting non-Newtonian characteristics over a wide range of viscosities. The spindle may be immersed in the agitated liquid in the supply tank to the pump and record actual viscosities in the system.

With such "on the spot" viscosity indications, the pump engineer can correctly estimate pipe friction, total pumping heads, proper size and speed of pumps and motors. He can take advantage of the lower viscosity of thixotropic liquids, yet safeguard the system against changes in the character of the liquid. Pumping systems will then be correctly engineered for highest efficiency, and the motors will be properly loaded.




Dow's Marine Chemist highlights a trend in chemical shipments. Multi-cargo tankers are serving a growing number of firms.

# Multi-Cargo Tankers for Chemicals

**Sea lanes are becoming important highways in the chemical industry. Here's how seven firms use tankers to haul bulk liquid chemicals to eastern markets.**

**RICHARD F. WARREN**

Warships are not the only things which create sea power. Chemical companies are proving this today as they switch from rail to water transportation. This trend is a result of the climbing rail freight rates. Many feel that railroads are beginning to price themselves out of the market in the case of some chemicals. The reason: a plant located on the West Coast can ship to the East Coast, pay the back-haul rail freight and still save about 35 percent on a corresponding coast-to-coast rail shipment. Actually this development is not exactly new. About 1939 Du Pont arranged to get methyl ethyl ketone and special petroleum fractions from Los Angeles to New Jersey by tanker. This was the first major step in moving chemicals by sea in multi-chemical tankers.

### DOW: details from stem to stern

In recent months Dow and Carbide have launched into contract arrangements with Marine Transport Lines, New York, on a long-term basis. Dow's ship (shown above) is a converted commercial tanker. Dow will use it to move caustic soda (50 percent), ethylene glycol, carbon tetrachloride, ethylene dichloride, propylene glycol, and some dry cargo in drums. This is another step forward to improve the distribution of Texas production of chemicals to the large consuming points throughout the country.

In converting Dow's tanker for transportation of chemicals, special bottoms were placed in the tanks to keep the chemicals free of contact with the skin of the ship. Double bulkheads were installed between tanks containing different products. Separate pumps and lines are provided for each product. The caustic soda and propylene glycol tanks are lined with seven coats of Amercoat 55 and Amercoat 23 respectively. All the other tanks can be used interchangeably to carry glycols and solvents which do not require lined or pressure vessels. The midship tanks (Nos. 4 through 7A) will carry caustic soda. Each of these tanks will carry almost 2,000 tons of 50 percent caustic. The No. 3 tank on the forward well deck will carry more than 1,800 tons of carbon tetrachloride. The No. 2 tank on the forward well deck will carry propylene glycol (about 485 tons). This tank is lined with seven coats of Amercoat 23. Aft of the mainmast are two more tanks. One will carry 766 tons of ethylene dichloride and another will carry about 1,300 tons of ethylene glycol. Just aft of the forecastle are two tanks which will carry dry drum cargo. They will hold 890 tons and 425 tons, respectively. Ballast tanks are arranged around the main tanks—eight on the port and eight on the starboard side.

Terminal facilities for this industrial movement have been constructed at the General American Tank Storage Co., Carteret, N. J. The tanks installed at these facilities for handling caustic soda are insulated and lined with an inert coating. They are equipped with nickel coils and heat exchangers to provide proper solution temperatures. This prevents crystallization and facilitates handling. Tankage for other products is also available. Several dry cargo terminals in the New York harbor area have been surveyed and tentatively facilities at Port New-

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RICHARD F. WARREN is *Market Editor of* Chemical Engineering. *During the war he was in a unique position to see the effect of most forms of sea power, when he served on the logistical planning staff of the V. Amphibious Corps, and on the regimental staff of the 18th Marine Regiment (Engineers).*

ark, N. J., have been selected. Other facilities for cargo have been constructed for Dow at Paterson Oil Terminal, Inc., Paulsboro, N. J., for carbon tetrachloride. It is expected that additional facilities will be installed at other points at a later date.

**CARBIDE: slightly larger**

Carbide took to the sea routes a few weeks after Dow put its tanker in commission. Carbide's ship is also chartered from and run by Marine Transport Lines. Its run will be between Texas City and Carteret, N. J. It is a T-2 tanker with a 15,000-ton displacement (slightly larger than Dow's). Carbide's ship has seven main tanks each with 300,000-gal. capacity and three smaller tanks each with 100,000-gal. capacity. These tanks will be used to haul methanol, acetone, normal b tanol, butyl acetate, ethyl acetate a d ethylene glycol. The 18 smaller wing (ballast) tanks will not be used to carry chemicals. They will carry petroleum or sea water ballast.

**UNION OIL: tanker trailblazer**

Before the war Union Oil Co. of California arranged for facilities to handle 50,000 to 100,000 bbl. of chemical storage at Paulsboro, N. J. This was used in moving the MEK mentioned in the first paragraph and petroleum fractions high in xylene and toluene to the eastern market. Union Oil used a standard commercial tanker. They found that if chemicals were loaded in the forward part of the ship and arranged so that the tanks were filled to different levels to allow a proper difference in hydrostatic pressure between tanks, they could eliminate any objectionable contamination through bulkhead leaks. Leakage that did occur was in a controlled direction, and did not bring their products below specification.

**SHELL: chemicals ride pickaback**

Back in February 1946, Shell Chemical began to move some of its products from Houston to New York by sea-going tankers. These ships are operated under contract for Shell Oil Co. which in turn sets aside space in two ships for the products of the chemical subsidiary. About four chemicals are normally carried at one time in the two tankers. These are carried along with other petroleum products of the Shell Oil Co. Among the chemicals moving from Houston to New York by this method are acetone, methyl ethyl ketone, methyl isobutyl ketone, methyl isobutyl carbinol, secondary butyl alcohol, ethyl alcohol and isopropyl alcohol. These two tankers make the run about two weeks per round trip and take about 25 trips per year. The chemical sections of these tankers are fitted with separate pumps and pipelines to prevent contamination by the other products carried aboard the tankers.

**ORONITE: Alkane by Canal**

Oronite Chemical Co., a Standard Oil of California subsidiary, has been using the Panama Canal route to move Alkane into the Gulf Coast and eastern markets since August. They make the trip in about three weeks. This building block for synthetic detergents has been finding wide use in the eastern market as a result of cost saving due to water transportation. No special lining or conversion features were necessary to transport this product in Standard Oil of Calif. tankers. They employ the same technique used by Union Oil of Calif. in protecting the more valuable products. The ports of call include San Francisco, Good Hope, La., and Bayway, N. J. It takes a tanker coming through the Canal from San Francisco to New Jersey about three weeks for a one-way trip.

**CELANESE: competes in east**

Celanese Corp. of America solved the problem of competing in the New England markets for formaldehyde by chartering a 2,000-ton tanker especially designed to move this basic chemical from Texas to New Haven, Conn. This ship has placed Celanese in a favorable competing position in the New England area in spite of the long distance required to bring the material to the final customers. Celanese at the present time is using a tanker to transport only one chemical. However, its stainless steel tanks can be used for multi-cargo operations.

**ESSO: isopropyl since '47**

Esso Standard Oil Co. makes isopropyl alcohol at Baton Rouge and moves it to Bayway, N. J., in an Esso Shipping Co. tanker of the 13,000 ton class. Esso has been moving this alcohol up from Louisiana since the first half of 1947. It plans to use a T-2 class tanker (16,000 tons) starting in 1950.

**DU PONT: methanol goes north**

Up from Texas comes Du Pont's methanol to General American's tank storage farm at Carteret, N. J. Du Pont's polychemicals department brings it up for distribution in that area. They can get about 1.7 million gallons aboard the chartered 10,500 ton tanker that makes the run from Texas to New Jersey. Du Pont started bringing in methanol by tanker in November 1948.

The firm started to ship ethyl chloride by sea in October 1949. The organic chemicals department gets this chemical up from Houston to Deepwater Point, N. J., in space set aside on a 5,300 ton tanker. The chemical is used in the department's tetra ethyl lead operations.

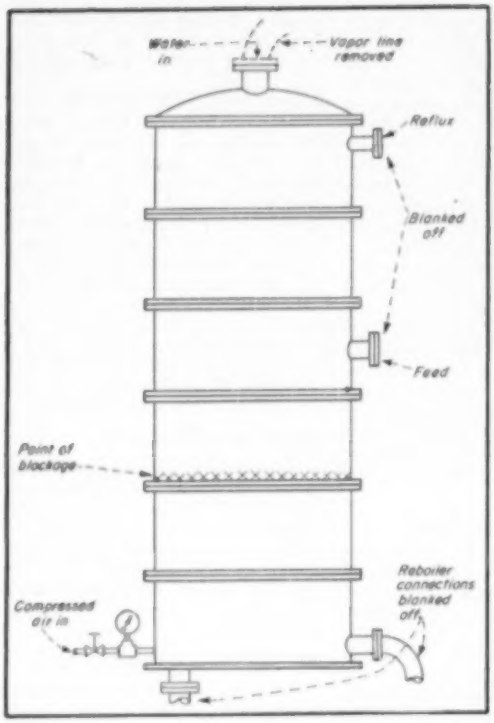
Other chemical companies are watching the accelerated trend to seaborne movement of bulk liquid chemicals with considerable interest. It seems probable that others will follow in the footsteps of these companies who have certainly proved that this type of shipment is both practical and economic.

## Who's Who in Seagoing Chemicals?

| Firms | Products Hauled | Tanker Size | Runs |
|---|---|---|---|
| Carbide and Carbon Chemical Corp. | acetone<br>methanol<br>n-butanol<br>butyl acetate<br>ethyl acetate<br>ethylene glycol | 15,000 tons | Texas City, Tex., to Carteret, N.J. |
| Celanese Corp. of America | formaldehyde | 2,000 tons | Corpus Christi, Tex. to New Haven, Conn. |
| Dow Chemical Co. | caustic soda<br>ethylene glycol<br>carbon tetrachloride<br>ethylene dichloride<br>propylene glycol | 13,000 tons | Freeport, Tex., to Paulsboro, N.J., and Port Newark, N. J. |
| E. I. du Pont de Nemours & Co. | methanol<br>ethyl chloride | 10,500 tons<br>5,300 tons (only part of tanker used) | Orange, Tex. to Carteret, N. J.<br>Houston, Tex. to Deepwater Point, N. J. |
| Esso Standard Oil Co. | isopropyl alcohol | 13,000 tons (only a portion of ship used for this chemical) | Baton Rouge, La., to Bayway, N. J. |
| Oronite Chemical Co. | Alkane | commercial T-2 (only part of ship used for Alkane) | San Francisco, Calif., to Good Hope, La., and Bayway, N. J |
| Shell Chemical Co. | acetone<br>ethyl alcohol<br>methyl ethyl ketone<br>isopropyl alcohol<br>methyl isobutyl ketone<br>methyl isobutyl carbinol<br>secondary butyl alcohol | commercial T-2 (only forward tanks on two vessels used for chemicals) | Houston, Tex., to New York |

# The Plant Notebook

THEODORE R. OLIVE, Senior Associate Editor




## How to Locate a Distilling Column Blockage Without Drilling Holes

MARSHALL NAUL, *Chemical Engineer, Roscoe, Ohio*

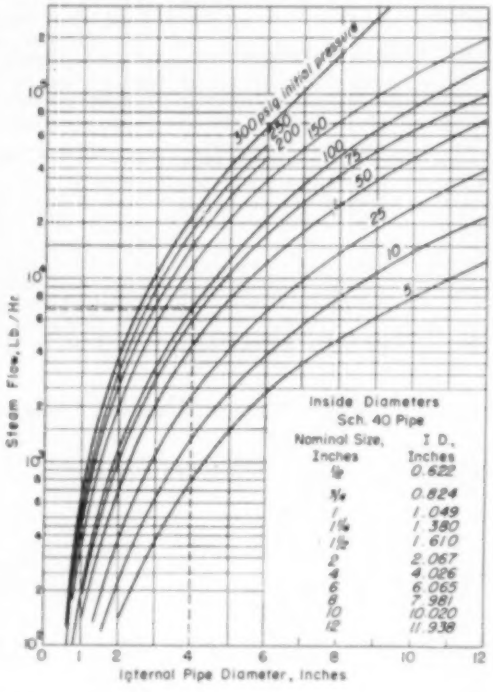
**November Contest Prize Winner**

In the Plant Notebook for September there was an article describing a method of locating blockages in distilling columns which will make the average plant engineer shudder. It was based on drilling several holes in the column, a scheme that is particularly impractical where column plugging and corrosion are inseparable, as in the production of chemical derivatives from natural gas by oxidation. The patching or reweldıng of high alloy columns is not to be taken lightly.

A method of locating column blockages which has been quite successful is described here. The drawing will make the principle clear. First it is necessary to blank off several lines to the column, including the vapor line from the reboiler, the liquid return line to the reboiler, the reflux line, and the feed line if it is below the top of the column. An air line and pressure gage must then be connected to some convenient fitting at the base of the column. By disconnecting the vapor line from the column to the condenser, it is possible to run a water hose in at that point.

By feeding water into the top of the column, simultaneous with the admission of air to the bottom, a point will be reached where the air pressure—after adjustment—will just balance the head of water above the blockage. Any extra water fed into the top will merely overflow the vapor outlet. So, to find the location of the blockage, it is merely necessary to express the air pressure as feet of water, then measure this distance down from the top of the column. Of course, where water cannot be used, any process liquid will work as well.

If the blockage is slight it will be necessary to make a rapid determination to prevent a build-up of water at the base which would prevent a correct pressure reading. Furthermore, in columns with a large number of plates, it may be necessary to make some successive approximations to eliminate error due to liquid level on plates below the blockage.



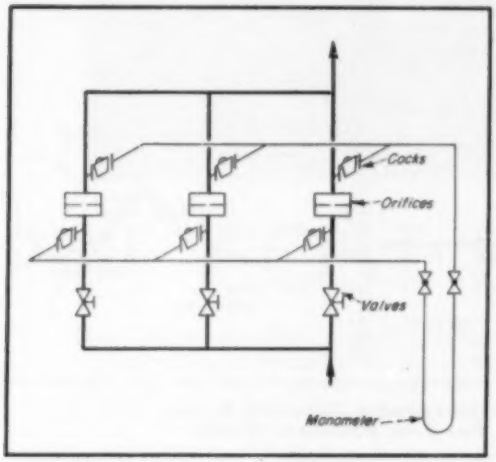

## Chart Sizes Steam Pipes Without Calculation

EDWARD J. GIBBONS, *Mechanical Engineer, New York 52, N. Y.*

With the chart shown here the problem of sizing steam piping can be reduced to picking values directly off the chart, with a single reading only for each length to be

selected. The usual procedure involves the assumption of a pipe size, calculation of the Reynolds number, determination of the friction factor from the Stanton diagram and, finally, calculation of the pressure drop from the Fanning equation. All of this is especially burdensome if the original assumption of pipe size happens to give an unreasonable value of the pressure drop. In that case, another trial calculation is needed.

This chart, calculated from steam flow formulas given in the Crane Co.'s Technical Paper No. 409, is so constructed that, for any initial pressure, the flow of saturated steam which will produce a drop of 2 percent or less of the initial pressure per 100 ft. of pipe, is immediately apparent for any internal pipe diameter from that of ¼-in. Sch. 40 pipe, to 12 in. For example, pipe of 4 in. I.D. will carry 6,800 lb./hr. of saturated steam with a pressure drop of 2 percent or less per 100 ft.




## Multiple Orifice Installation Saves on Meter Cost

ROBERT J. ARMSTRONG, *University of Texas, Austin, Tex.*

It is sometimes necessary for a wide range of flow rates be measured when a rotameter or an adjustable orifice is not available. This may be accomplished by connecting two or three metering orifices in parallel. If valves are installed as indicated in the illustration, each orifice may be used alone, or in combination with any other in the set. The pressure differentials can then be measured on a single manometer. The capacity of a combination of orifices in parallel will be very nearly the sum of the capacities of the individual orifices. Orifice diameters are best determined by the "cut and try" method in order to secure proper limits for each. Practical application of the method is limited to orifices which are to be calibrated.

As an example, a three-orifice set was constructed using flange-tap orifices in ½-in. pipe. Orifice diameters were $\frac{3}{16}$, $\frac{1}{4}$ and $\frac{1}{2}$ in. Water rates ranged from 640 to 1,500 lb./hr., using only the smallest orifice, and from 1,350 to 3,100 lb./hr. using only the next larger orifice. In parallel, these two orifices handled flow rates of 2,000 to 4,700 lb./hr. Rates varied from 3,900 to 8,900 lb./hr. using the largest orifice alone. Thus, a capacity ratio of 14:1 was obtained by using only these four combinations. The full range of the system was not required, but rates of about 5,900 to 13,500 lb./hr. could have been handled by using all three meters in parallel. This would have increased the capacity ratio to about 21:1.

The change from one orifice to another can be accomplished in a few seconds. The system may be checked rapidly for leaking valves, although this should be necessary only occasionally. No such difficulty was experienced during a period of four months operation of the set described.

## How to Reject Unreliable Data By Statistical Selection

JOSEPH T. HOGAN, *Engineer, New Orleans, La.*

Statistical theory is dependent on the fact that accidental errors, taken collectively, obey the law of probability. Since each accidental error is as likely to be positive as negative, a certain compensation effect exists when the number of observations is large. The probable error $r$ is the one which has most commonly been applied to a series of measurements by English and American authors as an index to the precision of measurement.

The theory does not function in its totality when the number of observations is small. In such cases the compensation effect is not produced in the computation of the mean, and the influence of a divergent reading on the magnitude of the mean is disproportionately large. It is generally conceded that the mean obtained would be closer to the true value if this reading were rejected.

Unfortunately we cannot reject a given reading of a series of observations on the basis of a "hunch". The question naturally arises: "When are we justified saying that an observation has too large an error and, therefore, should be discarded?"

The American mathematician, Chauvenet, developed a criterion which has been accepted generally for this purpose. Briefly stated: If there is an observation whose value differs from the mean by the quantity $Kr$, then the observation should be rejected as unreliable. $K$ is a factor by

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DECEMBER PRIZE WINNER—A $50 prize will be issued to . . .

HAROLD F. REICHARD
Chemical Engineer, Milltown, N. J.

. . . for an article describing a simplified scheme for unloading fuming or volatile liquids through the dome of a tank car without trouble from vapor lock or difficulty in disposing of hazardous fumes. This article, winner of our December contest, will appear in the February issue.

$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of *Chemical Engineering*, will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook.

The winner each month will be announced in the issue of the next month, e.g., the January winner will be announced in February and his article published in March. Judges will be the Editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at usual space rates.

HOW TO ENTER CONTEST—Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Articles may deal with any sort of plant or production "kink" or short-cut that will be of interest to chemical engineers or others in the process industries.

Also, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

which the probable error $r$ is multiplied to obtain the criterion for rejection of an observation. The value of $K$ tabulated for various values of $n$ (the number of observations) is given in Table I.

**Table I—Values of Chauvenet's Factor K for Various Numbers of Observations**

| n | K | n | K | n | K |
|---|---|---|---|---|---|
| 3 | 2.00 | 12 | 3.18 | 21 | 3.48 |
| 4 | 2.27 | 13 | 3.23 | 22 | 3.51 |
| 5 | 2.44 | 14 | 3.28 | 23 | 3.54 |
| 6 | 2.57 | 15 | 3.32 | 24 | 3.56 |
| 7 | 2.67 | 16 | 3.36 | 25 | 3.58 |
| 8 | 2.92 | 17 | 3.37 | 30 | 3.68 |
| 9 | 3.00 | 18 | 3.41 | 40 | 3.83 |
| 10 | 3.07 | 19 | 3.44 | 50 | 3.95 |
| 11 | 3.12 | 20 | 3.47 | 75 | 4.15 |

Suppose that 10 measurements have been made of a physical quantity. The determination of the mean and the deviations is shown in tabulated form in Table II. Here the probable error, from the standard formula, is:

$$r = \pm \frac{0.6745 \sqrt{5.73}}{\sqrt{n - 1}}$$

Where $n = 10$, $r = \pm 0.54$. Therefore, $Kr = 3.07 \times 0.54 = 1.66$, where the value of $K$ is taken for Table I.

**Table II—Ten Observations and Their Deviations**

| Observation No. | Value | Deviation | (Deviation)² |
|---|---|---|---|
| 1 | 76.3 | −0.2 | 0.04 |
| 2 | 77.5 | +1.0 | 1.00 |
| 3 | 75.9 | −0.6 | 0.36 |
| 4 | 77.2 | +0.7 | 0.49 |
| 5 | 75.8 | −0.7 | 0.49 |
| 6 | 76.3 | −0.2 | 0.04 |
| 7 | 77.0 | +0.5 | 0.25 |
| 8 | 77.8 | +1.3 | 1.69 |
| 9 | 75.4 | −1.1 | 1.21 |
| 10 | 76.1 | −0.4 | 0.16 |
| Mean = 76.5 | | | Σ = 5.73 |

Therefore, since all of the observations vary from the mean by an amount less than 1.66, there is no justification for rejection of any one of them. However, if the deviation of any observation had been greater than 1.66, it should be rejected in accordance with Chauvenet's criterion. After rejection of a value the probable error is then calculated for $(n - 1)$ observations and the criterion of Chauvenet again applied, and so on, until the data are consistent with values as determined by the method.

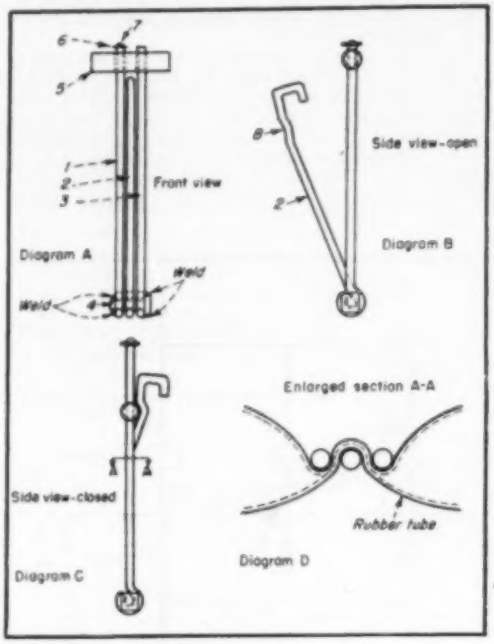
## Emergency Acid Inhibitor for Acidizing Treatments

FRANK GIBALDO, *Process Chemical Specialties, Beverly, Mass.*

On occasion it may be necessary to acid clean a batch of iron or steel, or some equipment of these materials. Usually, however, one does not have a suitable acid inhibitor at hand.

We have found that an effective impromptu acid inhibitor can be made by treating concentrated sulphuric acid with gas oils or various grades of light fuel oils. It may be that the effectiveness of inhibiting obtained depends on the quantity and type of unsaturates present in the oil. Therefore, it appears that mineral oils possessing a minimum of unsaturates will be preferable.

It is merely necessary to agitate the acid and oil together for 10 to 15 min. in a glass or other acid-resisting vessel, at a temperature preferably below 40 deg. F. It is believed that this temperature is not critical, but the lower the temperature, the less will be the charring of the lighter components. The layer of unreacted oil at the top should then be decanted and discarded, or the bottom layer of now inhibited sulphuric acid can be separated in a separatory funnel. The amount of oil-acid mixture used is of the order of 5 percent or less.




## Inexpenive Shut-Off Valve For Low Pressure Work

A. W. PLUMMER, *Kimberly-Clark Corp., Neenah, Wis.*

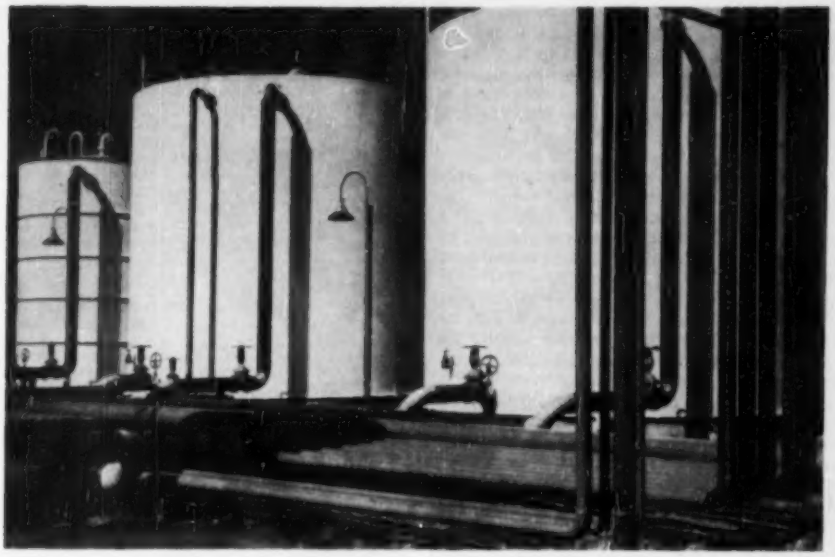
One of the costly items in a gas absorption pilot plant recently constructed promised to be the valves. We found that 16 were required, 8 each in the 6-in. gas and 2-in. liquor lines, all of which were lead. The valves were to be either fully open or fully closed. Corrosion resistance was a prerequisite.

The answer was a simple rubber sleeve valve closed by a clamp made of standard rod. The rubber tubing used, produced by the Western Rubber Co., has been in continuous service at pressures of 25-30 in. of $H_2O$ and has tested satisfactorily at 5 psig.

Basis of the method is the metal clamp shown in the accompanying diagrams. Three ¼-in. iron rods were bent around a ½ × 1-in. machine bolt, (4) in Diagram A. The two outside (1 and 3) were welded to the bolt and the middle one (2) left free to rotate about the bolt as center. The center rod was shaped as shown in Diagram *B*.

Closure around the tubing is accomplished in less than 5 sec. by pulling the inverted U-bend of the center rod between and slightly beyond the other two and slipping the ¼-in. brass rod (5) along the two outside rods until it locks itself at point (8). Opening in 1 sec. is accomplished in the reverse order. The screw (7) and washer (6) on one of the outside rods retain the sliding brass rod.

When closed a pressure seal results around the center rod, with particularly high unit pressure at diametrically opposite points as shown in diagram D. Ease and rapidity of opening and closing are important features.



# PIPE COST ESTIMATION

**Based on his method detailed in a forthcoming book, Mr. Dickson here shows how piping costs may be estimated accurately and more easily than by conventional methods. For best results current costs need be kept on only one size of each kind of pipe. For somewhat less accuracy this report contains all needed data.**

**R. A. DICKSON**

*Engineer, Caldwell, N. J.*

**CHEMICAL ENGINEERING REPORT—JANUARY 1950**

PIPING always represents a sizable part of the total installed cost of any process plant. It may run to 20 percent, or even more, of the entire cost of the plant, including land and buildings and may total from around 10 percent to as high as two-thirds of the cost of the equipment. But piping is usually complicated and often consists in a myriad of small, generally rather inexpensive parts. Its estimation can therefore be a headache to the estimator.

It makes his problem no easier that he is often called upon to prepare a reasonable estimate long before final plans are in existence, and before the project engineers have any idea how much piping will actually be needed. In this case he must not only be an estimator, but he must be able quickly to convert the preliminary flow sheet into a fair approximation of an actual design so that he may know what his estimate will involve. For this purpose the ability to make quick and rather accurate free-hand isometric sketches is of inestimable value.

However, the estimation of the piping need not be very arduous if the estimator will make use of the "*N*" system developed by the author during the last several years. This system, first disclosed in *Chemical Engineering* two years ago (R. A. Dickson, *Chem. Eng.*, Nov. 1947, pp. 121-3), has now been carried much farther and includes most kinds of pipe with which the chemical engineer is likely to be concerned. Through its use it is ordinarily necessary to have up-to-date cost data on only one size of each kind and class of pipe on which estimates may be necessary. If the estimator is willing to sacrifice some degree of accuracy, even that amount of keeping up with costs will not be needed, for the present article includes not only the "system" but also the data, which are accurate to July 1949.

The *N* system is based on the simple idea of recording, once and for all, the relative costs of various sizes of the same kind and class of pipe made up into a "string" consisting of pipe, fittings and valves. If one string of pipe taken as standard costs *X* dollars, and the same string made of another size of the same kind of pipe costs *Y* dollars, both installed, then $X/Y = N$. The *N* factor for each size can be calculated by actually figuring the cost of each string and comparing it with the cost of an arbitrarily

*This report presents in summarized and somewhat different form the data on pipe cost estimation by the author which will appear in the forthcoming book, "Industrial Piping," by C. T. Littleton and R. A. Dickson, to be published later this year by the McGraw-Hill Book Co.*

chosen standard or "reference" string. The *N* factors can then be recorded as a tabulation, or they can be plotted against nominal pipe size as a more or less smooth curve, as in this article. It is unimportant whether the resulting curve is entirely smooth or not. The important thing is that, although the absolute costs may vary widely over a period of time, tests have shown that the relative costs vary inappreciably. This means that with a table of *N* factors for any kind and class of pipe, it is necessary only to keep up with the cost variations for the reference size.

The main thing this article contributes, therefore, is a group of 66 *N* factor tabulations, some grouped, plotted in the 40 charts listed in Table II. Some are for bare pipe, some for 400 deg. F., 800 deg. F. or 0 to −25 deg. F. insulated pipe. Some are for a standard weight of pipe, such as Sch. 40, some for a heavier grade such as Sch. 80. In the case of the stainless alloys, some are also for the zephyr-weight grade. The list includes 21 different construction materials, but if different grades or weights of the same material are counted, this brings the total to 31. For 29 kinds and grades of pipe hot insulation costs are given, with cold insulation costs for 11.

In addition to the *N* factor plots, the article gives material and labor costs for the reference size in each *N* factor plot, based on July 1949 costs in the New York area. The data are presented as material, labor and total for: (*a*) 1 ft. of pipe; (*b*) one fitting, figured as a tee; and (*c*) one valve of the type specified in the caption for each chart. Incidentally, the abbreviations in these captions may be interpreted with the aid of Table III. In the original calculation each string was calculated as 1,000 ft. of pipe containing one fitting and one valve, since otherwise it would be impossible to allocate costs of welding, pipe fitting, bolting up flanges, and other factors to a single foot of pipe. The costs of materials and labor chargeable to the pipe were then divided by 1,000 to give the cost per foot of pipe.*

As an example of the form used in calculating the cost of each string for an *N* factor table or curve, consider the data in Table I pertaining to the reference size (2 in.) of the curve for low-temperature insulated pipe in Fig. 35. This particular calculation was selected for inclusion here because it shows practically every factor that may have to be included when doing such a job. It also offers a handy form for making cost calculations of the reference string for any kind and class of pipe when the estimator is using current cost data together with the *N* factor curves.

Table I is based on 2-in. Type 304 zephyr-weight stainless steel, insulated with special brine thickness cork. The specifications are given in Fig. 35.

It will be noted that the totals in the right-hand column of the table give the same data as are listed for cold-insulated pipe under Fig. 35. In Fig. 35 and a few others where there are too many data for the available space, it has been necessary to break down the totals for costs of 1 ft. of pipe, one fitting and one valve into their material and labor components in a separate footnote. In most cases, material (M), labor (L) and total (T) have been listed directly in the caption for 1 ft. of pipe (P), one fitting (F) and one valve (V).

Before going on to the use of the *N* factor charts, it will be worth while considering a few points concerning their method of derivation. In welded lines the cost of a flanged joint is included for each 200 ft. In any string having a screwed valve, provision is made for a union adjacent to the valve. In screw-joined strings the cost includes necessary couplings, and in flange-jointed strings, all necessary

**Table I—Example of Pipe String Calculation (Fig. 35).**

| | | | |
|---|---|---|---|
| 2 in. pipe, 1,000 ft. @ $2.35 | $2,350.00 | | |
| 2 x 6 in. flanges, 10 @ $6.65 | 66.50 | | |
| Bolts and gaskets | 23.34 | | |
| Weld rod, 11.5 lb. @ $0.75 | 9.63 | | |
| Insulation, 1,000 ft. @ $3.50 | 3,500.00 | Matl. | $5.95 |
| Miscellaneous | 1.83 | Labor | 1.41 |
| | $5,960.00 | | 7.36 |
| Handle and haul, 25 pc. @ $0.12 | 4.20 | | |
| Scrs.-ups (flanges), 6 @ $2.00 | 12.00 | | |
| Welds, 50 @ $1.12 | 56.50 | | |
| Insulators, 1,000 ft. @ $1.33 | 1,330.00 | | |
| Miscellaneous | 2.30 | | |
| | $1,405.00 | | |
| 2 in. fitting | $3.30 | | |
| Weld rod | 0.75 | | |
| Insulation | 7.70 | | |
| Miscellaneous | 0.25 | Matl. | $12.00 |
| | $12.00 | Labor | 6.50 |
| | | | $18.50 |
| Handle and haul | $0.12 | | |
| Welds, 2 @ $1.13 | 2.29 | | |
| Insulators | 3.82 | | |
| Miscellaneous | 0.17 | | |
| | $6.50 | | |
| 2 in. valve | $53.00 | | |
| Flanges, 2 @ $6.65 | 13.30 | | |
| Bolts and gaskets | 0.86 | | |
| Weld rod | 0.75 | | |
| Insulation | 10.35 | | |
| Miscellaneous | 4.20 | Matl. | $92.35 |
| | $92.35 | Labor | 12.15 |
| | | | 104.50 |
| Handle and haul | $0.36 | | |
| Scr.-ups, 2 @ $2.00 | 4.00 | | |
| Welds, 2 @ $1.13 | 2.26 | | |
| Insulators | 4.15 | | |
| Miscellaneous | 1.38 | | |
| | $12.15 | | |

flanges, as well as bolts and gaskets. Allowance is made for cost of handling and hauling all parts, for pipe-fitting, welding, weld rod, caulking materials in bell and spigot joints, and screw-ups of both screwed and bolted joints. Insulated strings include the cost for both material and labor in insulating each part with 85 percent magnesia for 400 deg., 85 percent magnesia and Superex for 800 deg. and special brine thickness cork for 0 to −25 deg. insulation.

### HOW N SYSTEM IS USED

As already mentioned, there are two ways in which the *N* system can be used: either with current data for the reference size of each kind needed, or by use of the reference size data given here. If the latter method is used, the accuracy will not be as high as by the first method and will depend on the accuracy with which the user can "factor" the July 1949 costs used here to the actual date of use. Unfortunately there are no very satisfactory methods regularly available for converting piping costs of one date to those of another. None of the usual cost indexes applies specifically to piping costs. The Marshall and Stevens indexes of comparative equipment costs regularly published in this magazine (see p. 137) probably offer a fair indicator of piping cost variations. Some engineers use the *Engineering News-Record* construction cost index, either as is or with modifications developed by the user. It is likely, however, that none of the various index series published by government bureaus and other organizations in the monthly *Survey of Current Business* is a particularly good indicator for pipe. So far as the author know, only the privately circulated Handy Index of Public Utility Costs contains an actual piping cost index.

Whichever method is employed, the use of the *N* factor charts is exactly the same. It is first necessary to calculate the cost of the reference string as so many feet of pipe, so many fittings and so many valves. A manifold can be handled as a string. The reference size is that size for

(*Continued on page 135*)

* Note that the *N* factor tables cover only the cost of the pipe string itself and do not include cost of burying or supporting the line, costs for which are too variable to include in cost tables. Calculation is not difficult. Many installations are supported on existing structures or laid on the ground.

**Table II—Piping Materials Covered in Figs. 1 to 40**

| Pipe | Fig. No. |
|---|---|
| Aluminum, std. wt., bare | 1 |
| Aluminum, std. wt., insulated 400 deg. F. and 0 to −25 deg. F. | 2 |
| Asbestos-cement, classes 100 and 150 | 3 |
| Brass, i.p.s., std. wt., bare | 4 |
| Brass, i.p.s., std. wt., insulated 400 deg. F. | 5 |
| Brass, i.p.s., extra heavy, bare | 6 |
| Brass, i.p.s., extra heavy, insulated 400 deg. F. | 7 |
| Brass, i.p.s., std. wt., silbrazed, bare | 8 |
| Brass, i.p.s., extra heavy, silbrazed, bare | 9 |
| Brass, i.p.s., std. wt., silbrazed, insulated 400 deg. F. | 10 |
| Brass, i.p.s., std. wt., silbrazed, insulated 0 to −25 deg. F. | 11 |
| Cast iron, bell and spigot, class C, 16 ft. lengths | 12 |
| Duriron | 13 |
| Durichlor | 14 |
| Glass, Pyrex | 15 |
| Inconel (use Type 316 charts Figs. 28–31 incl.) | |
| Lead, chemical, 2/16 in. wall | 16 |
| Lead, chemical, ¼ in. wall | 17 |
| Monel (use Type 304 charts, Figs. 32, 33) | |
| Nickel (use Type 316 charts, Figs. 28–31 incl.) | |
| Porcelain | 18 |
| Steel, pre-insulated 300 deg. F., std. wt. | 19 |
| Steel, pre-insulated 500 deg. F., extra heavy | 20 |
| Steel, butt-welded, std. wt., black, bare and insulated 400 deg. F. | 21 |
| Steel, butt-welded, std. wt., galvanized, bare and insulated 400 deg. F. | 21 |
| Steel, seamless, std. wt., black, bare | 23 |
| Steel, seamless, std. wt., black, insulated 400 deg. F and 0 to −25 deg. F. | 24 |
| Steel, seamless, extra heavy, black, bare and insulated 400 deg. F., ⅛ to 2 in. | 25 |
| Steel, seamless, extra heavy, black, bare, 4 to 24 in. | 26 |
| Steel, seamless, extra heavy, black, insulated 400 deg. F., 4 to 24 in. | 27 |
| Steel, stainless, Types 316 and 347, std. wt., screwed joints, bare | 28 |
| Steel, stainless, Types 316 and 347, std. wt., screwed joints, insulated 400 deg. F. | 29 |
| Steel, stainless, Types 316 and 347, std. wt., welded, bare and insulated 400 deg. F. | 30 |
| Steel, stainless, Types 316 and 347, std. wt., welded, insulated 0 to −25 deg. F. | 31 |
| Steel, stainless, Type 304, std. wt., bare and insulated 400 deg. F. and 0 to −25 deg. F. | 32 |
| Steel, stainless, Type 304, extra heavy, bare and insulated 500 deg. F. | 33 |
| Steel, stainless, Type 316, zephyr wt., bare and insulated 400 deg. F. and 0 to −25 deg. F. | 34 |
| Steel, stainless, Type 304, zephyr wt., bare and insulated 400 deg. F. and 0 to −25 deg. F. | 35 |
| Steel, stainless, Type 347, zephyr wt., bare and insulated 400 deg. F. and 0 to −25 deg. F. | 36 |
| Steel, lead-lined, 3/16 in. thick | 37 |
| Steel, rubber-lined, 3/16 in. thick | 38 |
| Steel, Saran-lined, std. wt., screwed | 39 |
| Steel, Saran-lined, std. wt., flanged | 40 |

**Table III—Abbreviations Used in Captions**

| | | | |
|---|---|---|---|
| Al | Aluminum | Mag. | Magnesia |
| B & S | Bell and spigot | O S & Y | Outside screw & yoke |
| brs. | brass | P | Pipe |
| brz. | bronze | Pb | lead |
| C I | Cast iron | rl. | rubber lined |
| cwp. | cold water pressure | S. B. T. | Special brine thickness |
| deg. F. | degrees Fahrenheit | scr. | screwed |
| F | fitting | Ser. | Series |
| fgd. | forged | silb. | silbrazed |
| fl. | flanged | S. S. | Stainless steel |
| Fl. | Flanges | std. wt. | standard weight |
| g. | gate | stl. | steel |
| insul. | insulated or insulation | T | Total cost |
| i. p. s. | iron pipe size | th. | thick or thickness |
| L | Labor cost | V | valve |
| ll. | lead lined | wld. | welded or welding |
| M | Material cost | XH | extra heavy |

Note—Superior numbers refer to footnotes at end of article detailing costs where insufficient space for all figures exists in captions.

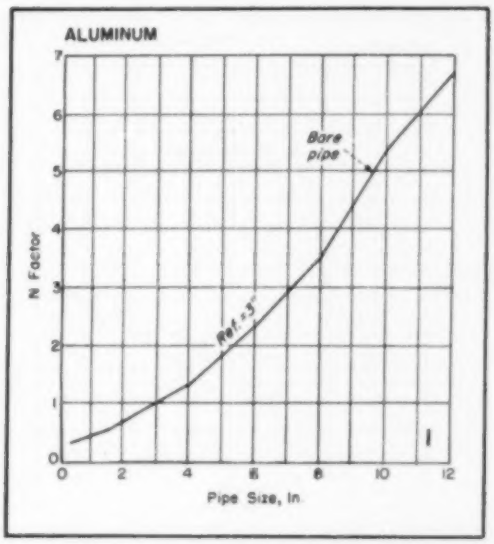



Fig. 1—ALUMINUM: Pipe, alloy 61S-T6, std. wt., ½ to 12 in., welded, bare. Fittings, Al, welding. Valves, Al scr. gate to 1 in., Al flanged gate, 1¼ to 12 in. 125 lb.

| | 3 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $1.96 | 0.11 | 2.07 |
| F | 15.00 | 7.00 | 22.00 |
| V | 135.00 | 12.00 | 147.00 |

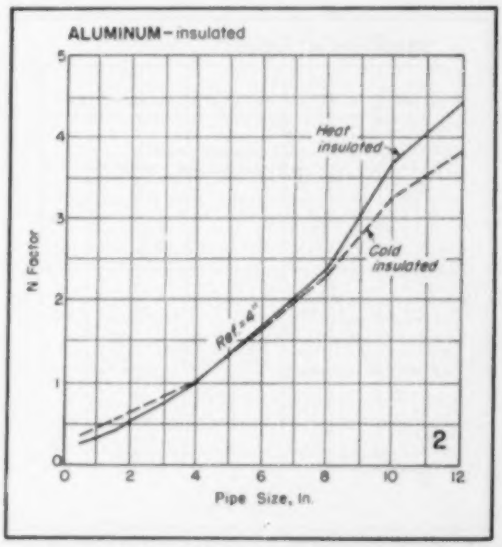



Fig. 2—ALUMINUM: Pipe, fittings and valves same as Fig. 1; ½ to 12 in. Insulated 85% Mag. 400 deg., S.B.T. cork for 0 to −25 deg. F.

| | 4 in., 400 deg. | | | 4 in., 0 to −25 deg. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $3.80 | 0.40 | 3.99 | $7.46 | 1.96 | 9.42 |
| F | 21.41 | 10.15 | 31.56 | 31.50 | 14.00 | 45.50 |
| V | 175.41 | 15.15 | 190.56 | 197.30 | 33.45 | 230.75 |

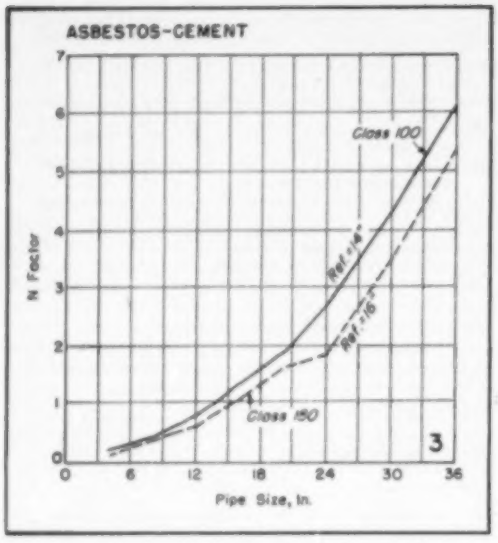



Fig. 3—ASBESTOS-CEMENT: Classes 100 and 150, 4 to 36 in. Fittings, CI, all bells, class D. Valves, C.I.B.M. flanged gate OS & Y 125 lb. for class 100, 250 lb. for class 150.

| | 14 in., Class 100 | | | 16 in., Class 150 | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $4.10 | 0.20 | 4.30 | $5.80 | 0.35 | 6.15 |
| F | 70.00 | 15.00 | 85.00 | 90.00 | 20.00 | 110.00 |
| V | 400.00 | 35.00 | 435.00 | 900.00 | 40.00 | 940.00 |

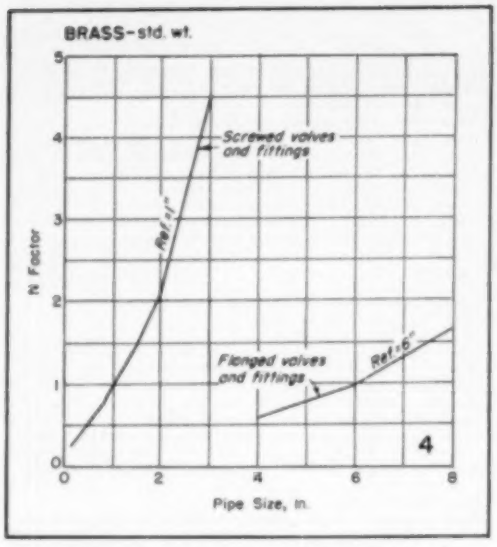



Fig. 4—BRASS, red: Pipe, i.p.s., std. wt., ¼ to 8 in., bare. F to 3 in., brz. scr. 125 lb.; 4 to 8 in. brz. fl. 150 lb. V. brz. scr. g. 200 lb. cwp. and brz. g. fl. 150 lb.

| | 1 in. | | | 6 in. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $0.90 | 0.08 | 0.98 | $11.31 | 0.60 | 11.91 |
| F | 1.02 | 1.18 | 2.20 | 160.00 | 30.00 | 190.00 |
| V | 8.00 | 1.60 | 9.60 | 210.00 | 30.00 | 240.00 |

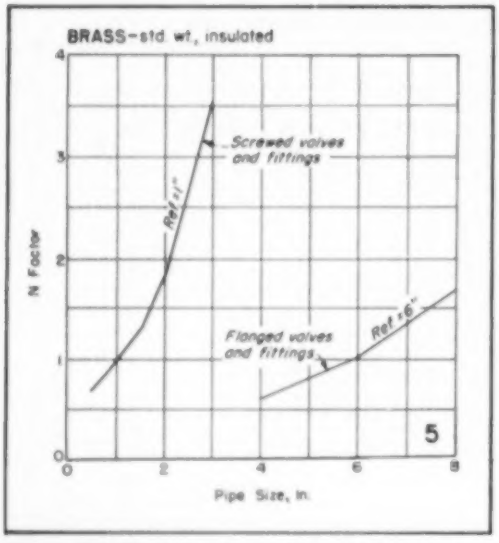



Fig. 5—BRASS, red: Pipe, i.p.s., std. wt., ¼ to 8 in. Fittings and valves, same as Fig. 4. Insul. 400 deg. F., using 85% Mag. 1¼ in. th. to 3 in., 2½ in. th. 4 to 8 in.

| | 1 in. | | | 6 in. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $1.22 | 0.29 | 1.51 | $13.34 | 0.85 | 14.19 |
| F | 1.20 | 1.20 | 2.40 | 161.00 | 30.00 | 191.00 |
| V | 8.20 | 1.60 | 9.80 | 211.00 | 30.00 | 241.00 |

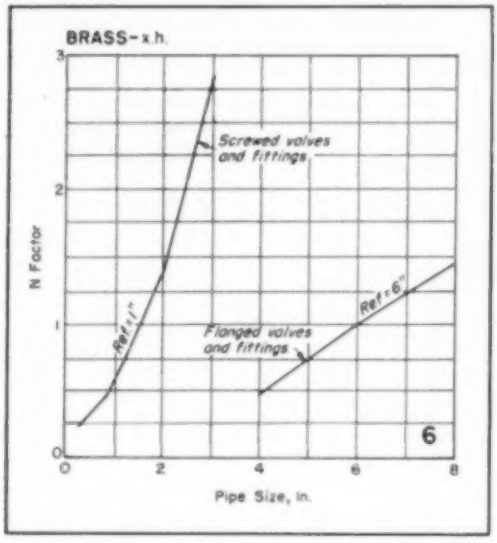



Fig. 6—BRASS, red: Pipe, i.p.s., XH, ¼ to 8 in., bare. Size ¼ to 3 in., F brz. scr. 250 lb., V brz. scr. g. 300 lb. Size 4 to 8 in., F brs. fl. 250 lb., V brs. fl. g. 250 lb. cwp.

| | 1¼ in. | | | 6 in. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $1.98 | 0.10 | 2.08 | $20.10 | 0.55 | 20.65 |
| F | 2.50 | 1.50 | 4.00 | 270.00 | 20.00 | 290.00 |
| V | 15.00 | 2.00 | 17.00 | 330.00 | 15.00 | 345.00 |

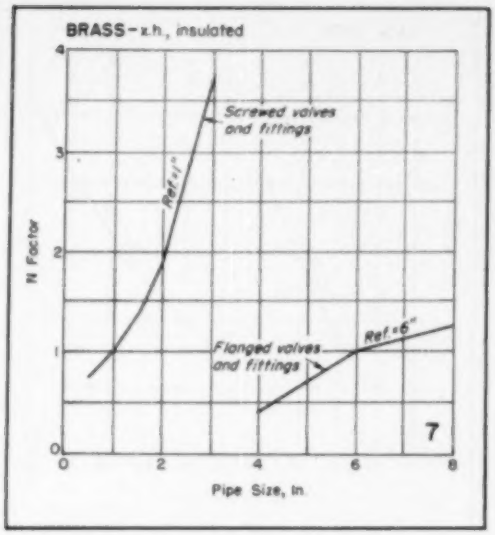



Fig. 7—BRASS, red: Pipe, i.p.s., XH, ½ to 8 in. Insulated, 800 deg. Fittings same as Fig. 6, valves as in Fig. 6 except 300 lb. Insulation sponge felt and Superex, 800 deg. F.

| | 1 in. | | | 6 in. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $2.34 | 0.37 | 2.71 | $25.44 | 0.88 | 26.32 |
| F | 1.77 | 1.31 | 3.08 | 272.73 | 20.68 | 293.41 |
| V | 8.27 | 2.06 | 10.33 | 332.73 | 15.68 | 348.41 |

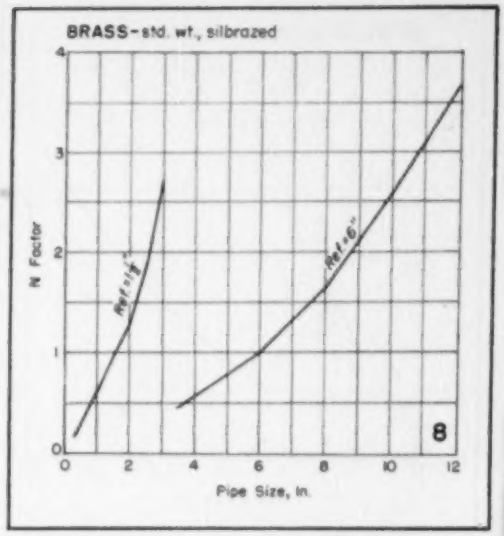



Fig. 8—BRASS, red: Pipe, i.p.s., std. wt., ½ to 12 in., slb., bare. F brs. slb. Size to 3 in., V brz. slb., size 3½ to 12 in. V brz. fl. wedge g. OS & Y; Fl. brs. 150 lb.

| | 1½ in. | | | 6 in. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $1.80 | 0.09 | 1.89 | $13.50 | 0.45 | 13.95 |
| F | 4.00 | 1.50 | 5.50 | 66.00 | 5.80 | 71.80 |
| V | 7.00 | 1.50 | 8.50 | 250.00 | 17.00 | 267.00 |

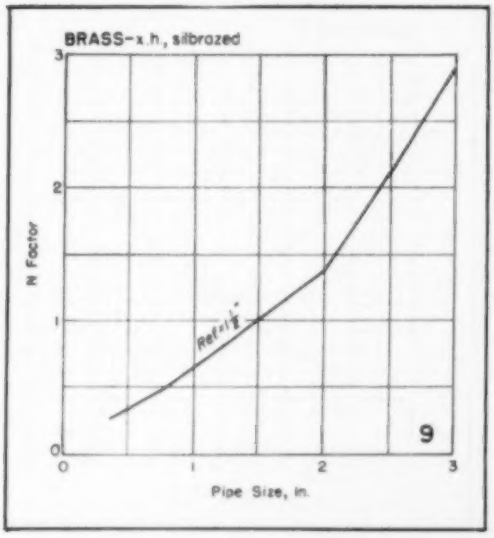



Fig. 9—BRASS, red: Pipe, i.p.s., XH, ½ to 3 in., slb., bare. Fittings, brass, silbraze ends, 250 lb. Valves, bronze gate, silbraze ends, 300 lb.

| | 1½ in. | | |
|---|---|---|---|
| | M | L | T |
| P | $2.54 | 0.12 | 2.66 |
| F | 11.00 | 1.50 | 12.50 |
| V | 20.00 | 1.50 | 21.50 |

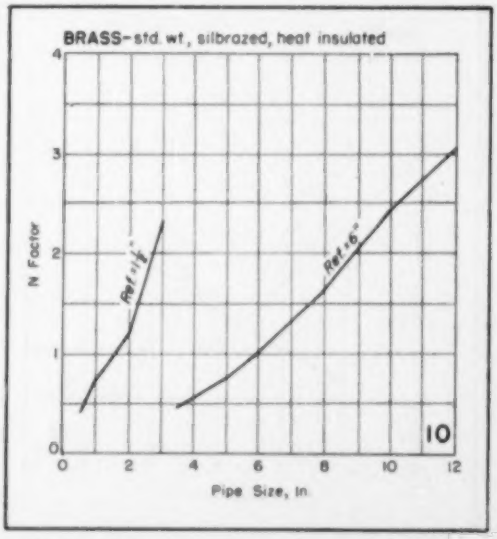



Fig. 10—BRASS, red: Pipe, i.p.s., std. wt., ½ to 12 in., slb. Insulated 400 deg. Fittings and valves same as Fig. 8 for sizes to 3 in. and 3½ to 12 in. Insul. 85% Mag. 400 deg.

| | 1½ in. | | | 6 in. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $2.27 | 0.30 | 2.57 | $14.60 | 0.70 | 15.30 |
| F | 4.25 | 1.50 | 5.81 | 66.64 | 5.74 | 72.38 |
| V | 7.35 | 1.56 | 8.81 | 250.64 | 17.24 | 267.88 |

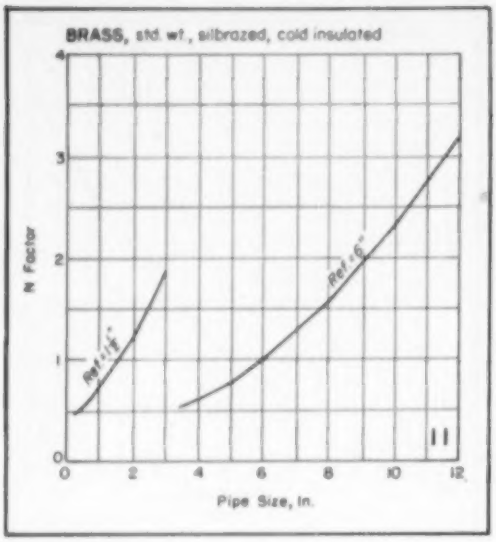



Fig. 11—BRASS, red: Pipe, i.p.s., std. wt., ¼ to 12 in., slb., insulated 0 to −25 deg. F. Fittings and valves same as Fig. 8 for sizes to 3 in. and 3½ to 12 in. Insul. S.B.T. cork.

| | 1½ in. | | | 6 in. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $3.77 | 1.10 | 4.90 | $18.37 | 3.25 | 21.62 |
| F | 10.60 | 4.00 | 14.60 | 81.30 | 11.30 | 92.60 |
| V | 13.60 | 4.00 | 17.60 | 279.00 | 30.00 | 309.00 |

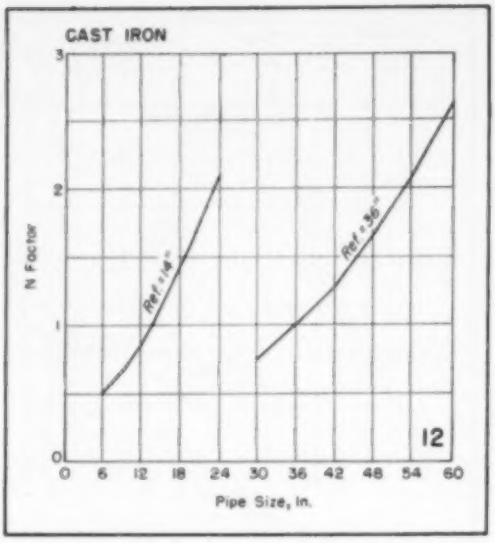



Fig. 12—CAST IRON: Pipe, CI, B & S class C, tar-coated, 6 to 60 in. Fittings CI, B & S, class D. Valves, CI, brz. mounted O S & Y, fl. gate, 125 lb.

| | 14 in. | | | 36 in. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $9.45 | 3.51 | 12.96 | $27.00 | 21.90 | 49.50 |
| F | 101.00 | 41.00 | 142.00 | 600.00 | 137.00 | 737.00 |
| V | 360.00 | 185.00 | 545.00 | 3,000.00 | 310.00 | 3,310.00 |

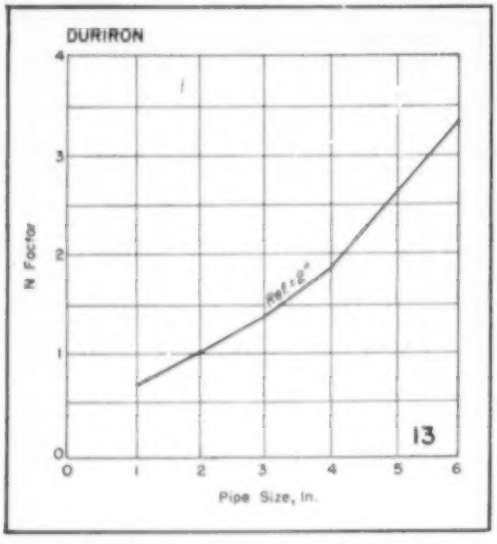



Fig. 13—DURIRON: Pipe, Duriron, split fl., 1 to 6 in., bare, 3 ft. long to 1½ in., 4 ft. for 2 in., 5 ft. to 6 in. Fittings, DI split fl. Valves, DI lube. plug, straight-way, flanged.

| | 2 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $5.48 | 1.70 | 7.18 |
| F | 14.20 | 19.00 | 33.20 |
| V | 60.00 | 15.00 | 75.00 |

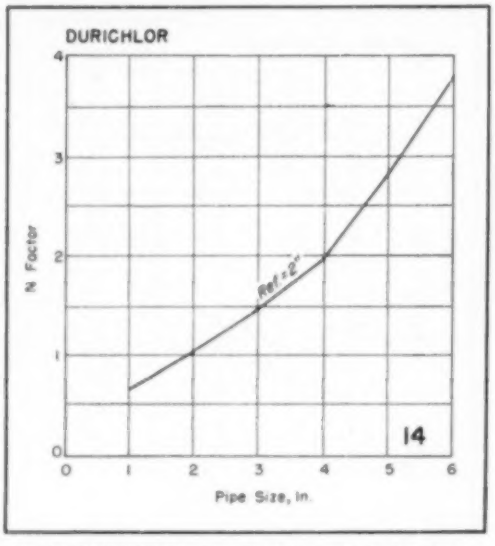



Fig. 14—DURICHLOR: Pipe, Durichlor, split fl., 1 to 6 in., bare. Fittings, Durichlor split flange. Valves, Durichlor lube. plug, straight-way flanged.

| | 2 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $9.60 | 1.60 | 11.20 |
| F | 21.00 | 19.00 | 40.00 |
| V | 78.00 | 13.00 | 91.00 |

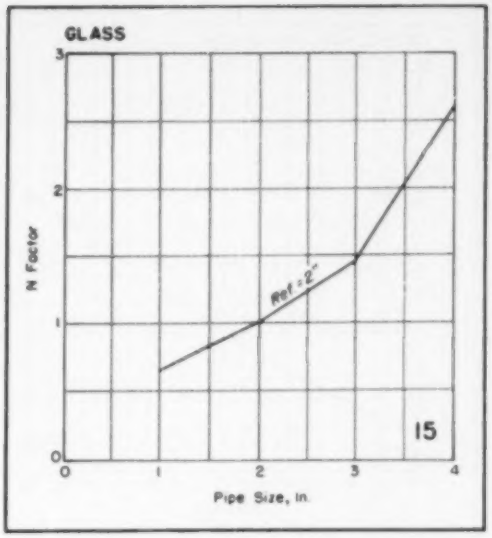



Fig. 15—GLASS: Pipe, Pyrex glass, 10 ft. lengths, 1 to 4 in., bare. Fittings, Pyrex glass. Valves, Type 316 S.S. fl. g. Ser. 15. Flanges, CI.

| | 2 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $1.42 | 0.21 | 1.63 |
| F | 22.00 | 17.00 | 39.00 |
| V | 74.00 | 11.00 | 85.00 |

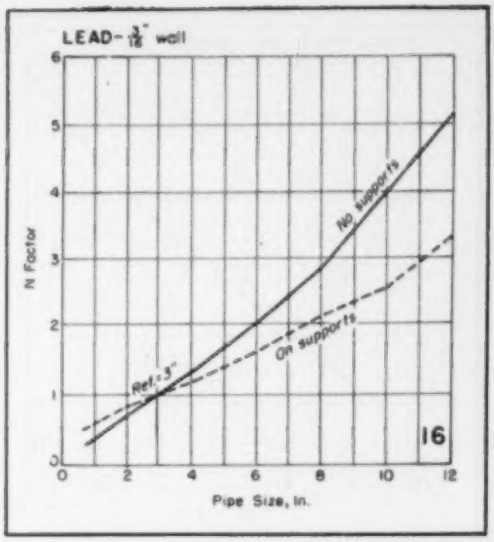



Fig. 16—LEAD: Pipe 99.9% chem. Pb, 3/16 in. wall, ¾ to 12 in. Fittings, Pb, plain ends. Valves, Pb, bolted bonnet Y type, fl. Flanges, Ser. 15 stl., slip-on.

| | 3 in. | | | |
|---|---|---|---|---|
| | M | L | T | |
| P* | $2.44 | 1.25 | 3.69* | (*T = $6.99 for pipe on supports.) |
| F | 6.00 | 7.00 | 13.00 | |
| V | 55.00 | 7.00 | 63.00 | |

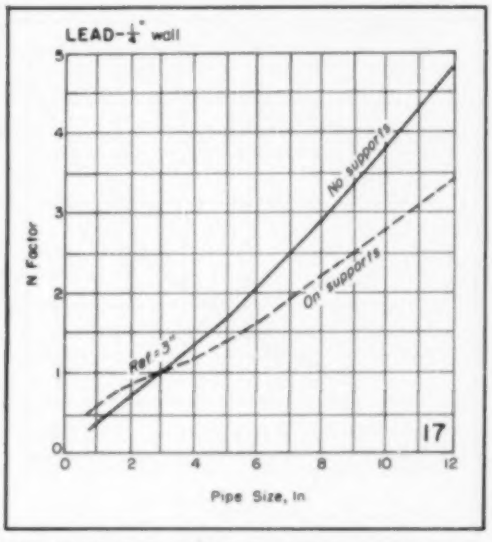



Fig. 17—LEAD: Pipe 99.9% chem. Pb, ¼ in. wall, ¾ to 12 in. Lengths 10 ft. Fittings and valves same as Fig. 16. Unsupported pipe considered laid on existing supports or ground.

| | 3 in. | | | |
|---|---|---|---|---|
| | M | L | T | |
| P* | $3.30 | 1.66 | 4.96* | (*T = $9.45 for pipe on supports.) |
| F | 6.00 | 7.00 | 13.00 | |
| V | 55.00 | 7.00 | 62.00 | |

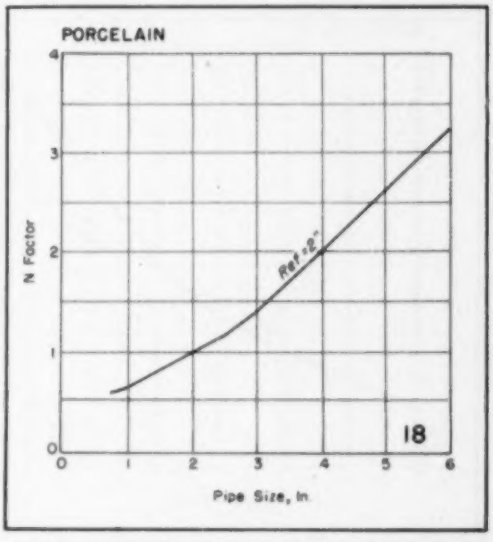



Fig. 18—PORCELAIN: Pipe, chemical porcelainware with flared ends, 5 ft. lengths, ¾ to 6 in. Fittings and valves all chemical porcelainware.

| | 2 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $2.35 | 2.20 | 4.55 |
| F | 9.00 | 7.00 | 16.00 |
| V | 80.00 | 5.00 | 85.00 |

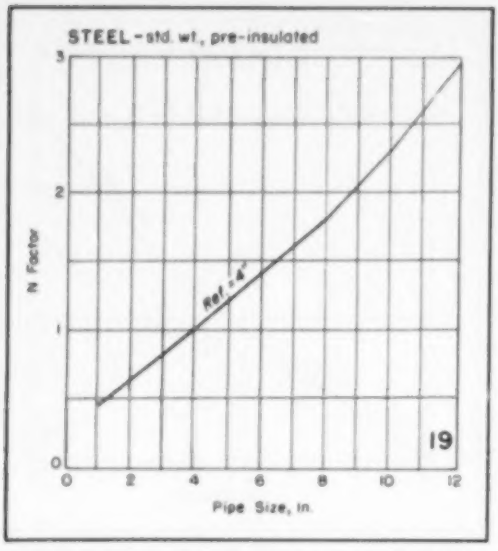



Fig. 19—STEEL, pre-insulated: Pipe, std. wt. seamless black, Ric-Wil, 1-12 in., insul. 1½ in. for 300 deg. F. F, std. wt. stl. welding. V, cast stl. fl. g. Ser. 15. Data from mfr.

| | 4 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $3.25 | 0.72 | 3.97 |
| F | 10.71 | 10.15 | 20.86 |
| V | 110.41 | 14.35 | 124.76 |

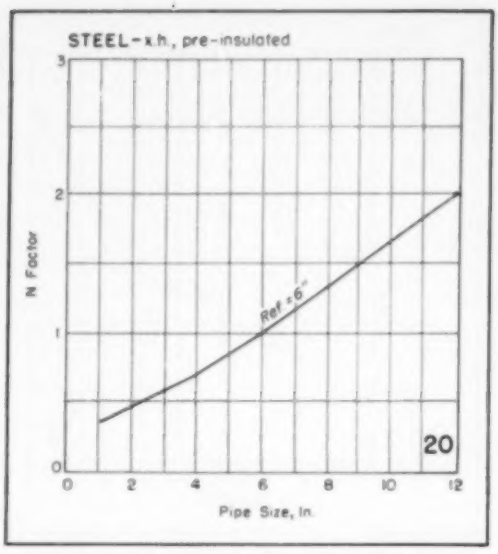



Fig. 20—STEEL, pre-insulated: Pipe XH, seamless black, Ric-Wil, 1 to 12 in., insul. 2 in. for 500 deg. F. Fittings XH stl., wld. Valves, cast stl. fl. g. Ser. 30. Data from mfr.

| | 6 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $5.22 | 1.30 | 6.52 |
| F | 26.22 | 16.80 | 43.02 |
| V | 269.00 | 22.30 | 291.30 |

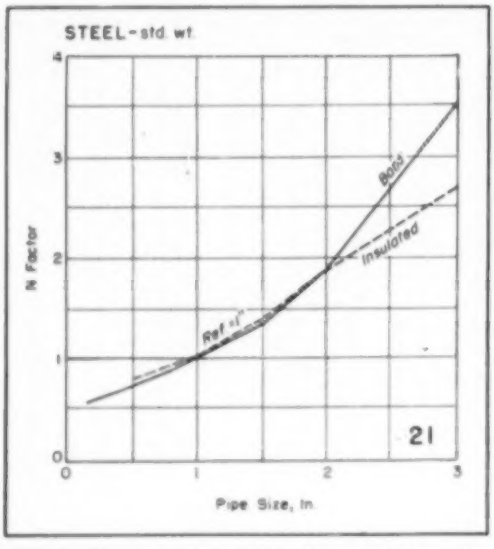



Fig. 21—STEEL: Pipe, butt welded, std. wt. black, bare and 400 deg. insul., ¼ to 3 in. F, fgd. stl. scr. 2,000 lb. cwp. V, brz. g. scr. 200 lb. cwp. Insul. std. th. 85% Mag.

| | 1 in., bare | | | 1 in., 400 deg. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $0.10 | 0.03 | 0.13 | $0.42 | 0.22 | 0.64 |
| F | 1.50 | 3.00 | 4.50 | 1.50 | 3.00 | 4.50 |
| V | 8.00 | 3.00 | 11.00 | 8.00 | 3.00 | 11.00 |

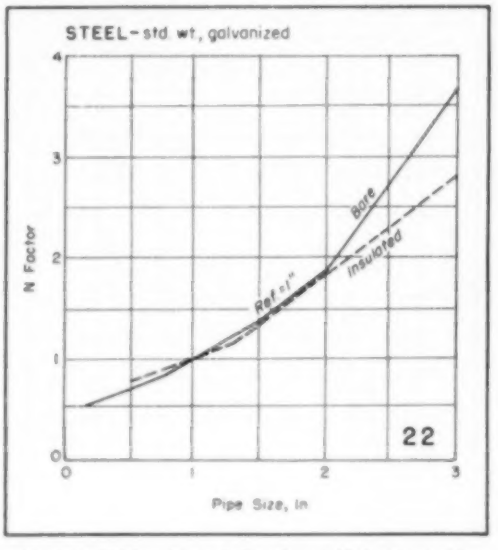



Fig. 22—STEEL, galvanized: Pipe, butt welded, std. wt. galv., bare and 400 deg. insul., ¼ to 3 in. F, mal. iron, scr. galv. V., brz. scr. g. 200 lb. cwp. Insul. std. th. 85% Mag.

| | 1 in., bare | | | 1 in., 400 deg. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $0.15 | 0.05 | 0.20 | $0.47 | 0.27 | 0.72 |
| F | 1.60 | 3.00 | 4.60 | 1.74 | 3.20 | 4.94 |
| V | 8.00 | 4.00 | 12.00 | 8.14 | 4.04 | 12.18 |

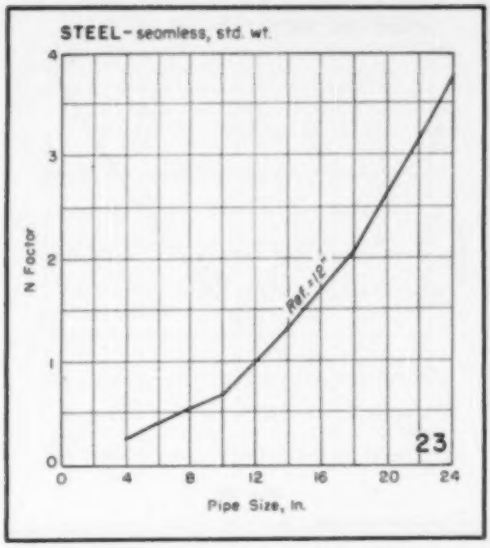



Fig. 23—STEEL, seamless: Pipe, std. wt. black, bare, 4 to 24 in. Size 4 to 10 in., Sch. 40, Size 12 to 24 in., 0.375 in. wall. F std. wt. stl. wld. Fl. fgd., V cast stl. fl. g. Scr. 15.

| | 12 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $4.00 | 0.96 | 4.96 |
| F | 95.00 | 18.00 | 113.00 |
| V | 535.00 | 70.00 | 605.00 |

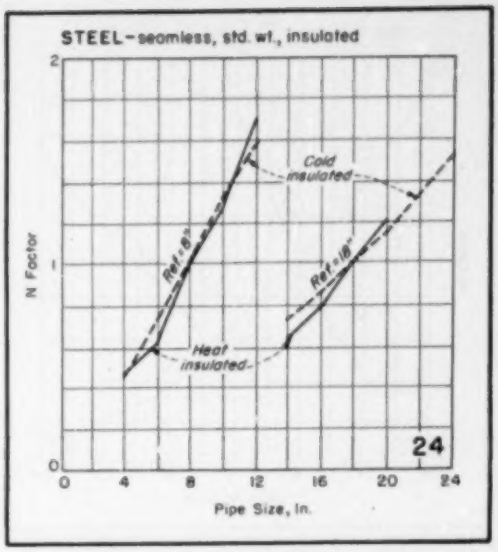



Fig. 24—STEEL, seamless: 4 to 24 in., insul. 400 deg. F. and 0 to −25 deg. F. Pipe, fitting and valve all as in Fig. 23. Insul. 85% Mag. 400 deg. and heavy duty th. cork −25 deg.

| | 8 in., 400 deg. | 18 in., 400 deg. | 8 in., −25 deg. | 18 in., −25 deg. |
|---|---|---|---|---|
| | Total[1] | Total[1] | Total[2] | Total[2] |
| P | $5.21 | 12.71 | 15.92 | 31.97 |
| F | 62.38 | 244.42 | 103.15 | 332.73 |
| V | 336.42 | 1,507.00 | 417.80 | 1,673.00 |

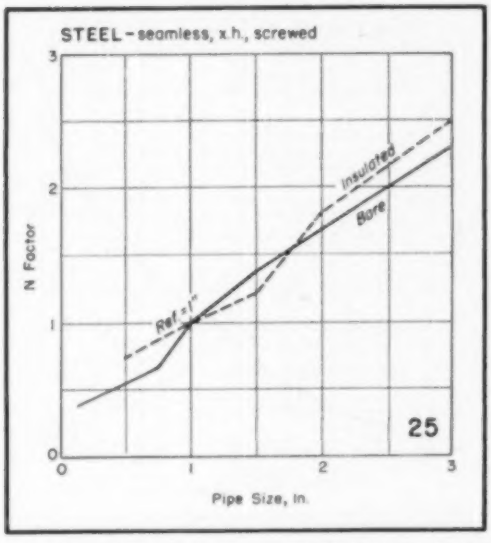



Fig. 25—STEEL, seamless: Pipe, XH, black, bare and 800 deg. F. insul., ½ to 3 in. F fgd. stl. scr. 2,000 lb. cwp., V fgd. stl. g. scr. 600 lb. cwp. Superex and 85% Mag. 800 deg.

| | 1 in., bare | | | 1 in., 800 deg. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $0.33 | 0.05 | 0.40 | $1.00 | 0.35 | 1.35 |
| F | 1.70 | 3.00 | 4.70 | 2.02 | 3.01 | 5.03 |
| V | 22.62 | 4.00 | 26.62 | 32.89 | 4.06 | 36.95 |

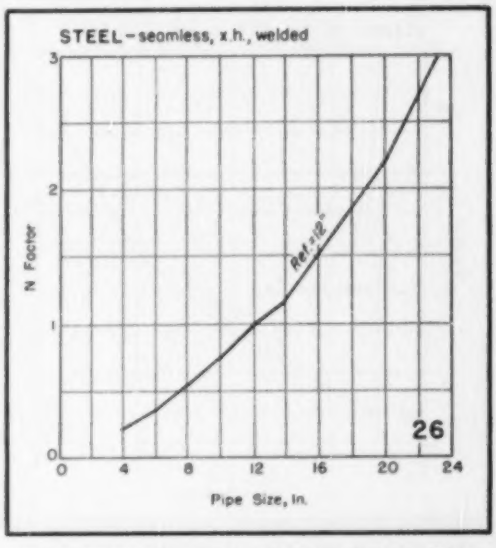



Fig. 26—STEEL, seamless: Pipe, black, XH, bare, 4 to 24 in. Size 4 to 10 in., Sch. 80; size 12 to 24 in., 0.625 wall. F stl. XH wld. V cast stl. fl. g. Scr. 30. Fl. fgd. Scr. 30, wld.

| | 12 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $4.62 | 1.37 | 5.99 |
| F | 145.00 | 34.00 | 179.00 |
| V | 773.00 | 80.00 | 853.00 |

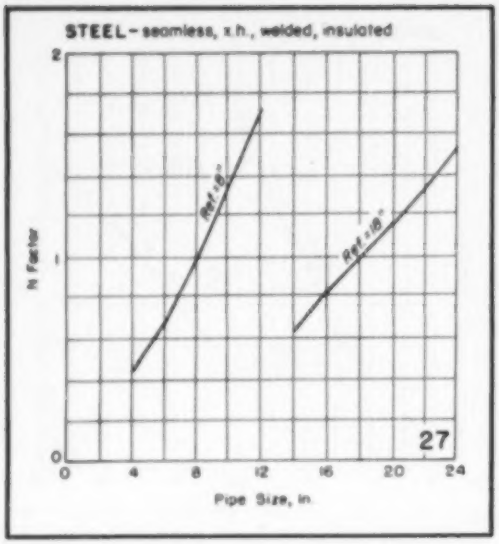



Fig. 27–STEEL, seamless: 4 to 24 in., insul. 800 deg. F. All pipe, fittings, valves same as Fig. 26. Insulation for 800 deg. is 85% Mag. and Superex.

| | 8 in. | | | 18 in. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $6.44 | 1.12 | 7.56 | $14.26 | 3.33 | 17.59 |
| F | 67.00 | 26.00 | 93.00 | 286.20 | 42.00 | 328.20 |
| V | 406.00 | 50.00 | 456.00 | 1,752.40 | 112.60 | 1,864.00 |

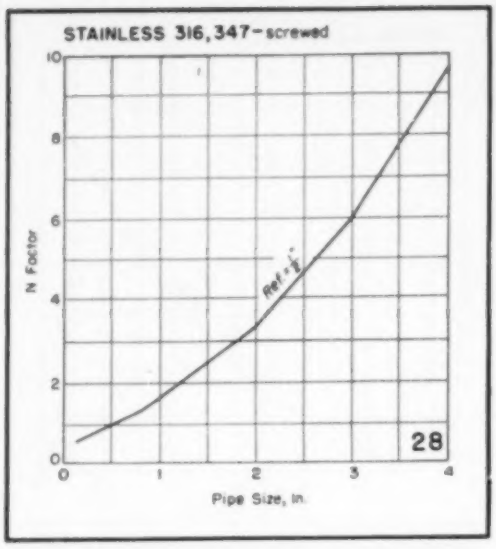



Fig. 28–STEEL, stainless, types 316, 347: Pipe, std. wt. bare, scr. joints, ¼ to 4 in. Fittings and valves, same metal, 150 lb. screwed.

| | ¼ in. | | |
|---|---|---|---|
| | M | L | T |
| P | $3.15 | 0.04 | 3.19 |
| F | 1.85 | 2.00 | 3.85 |
| V | 25.50 | 3.00 | 28.50 |

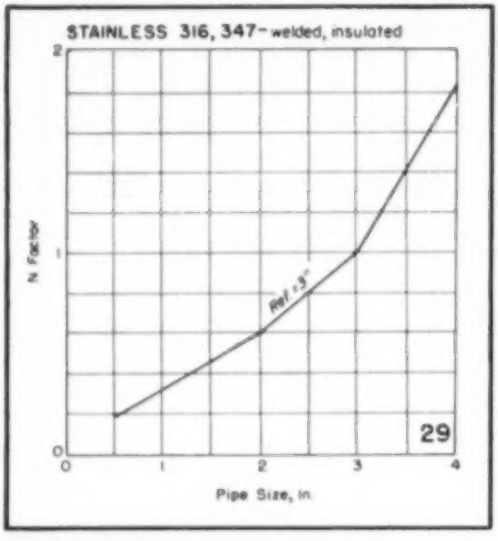



Fig. 29–STEEL, stainless, types 316, 347: ¼ to 4 in., insulated 400 deg. F. Pipe, fittings and valves all same specifications as Fig. 28. Insul. 85% Mag. 400 deg F.

| | 3 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $19.44 | 0.61 | 20.05 |
| F | 20.54 | 1.95 | 22.49 |
| V | 142.28 | 4.11 | 146.39 |

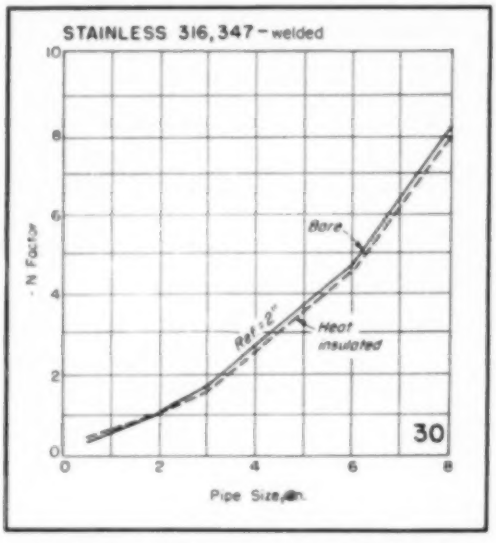



Fig. 30–STEEL, stainless, types 316, 347; Pipe, std. wt., ¼ to 8 in., bare and insul. Size to 4 in. F scr. V 150 lb. scr. Size 6 to 8 in., F wld., V fl. Scr. 15 same metal. Insul. 85% Mag.

| | 2 in., bare | | | 2 in., 400 deg. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $10.85 | 0.13 | 10.98 | $11.27 | 0.41 | 11.68 |
| F | 23.00 | 4.37 | 27.37 | 23.33 | 4.86 | 28.19 |
| V | 95.00 | 4.24 | 99.24 | 95.83 | 3.98 | 99.81 |

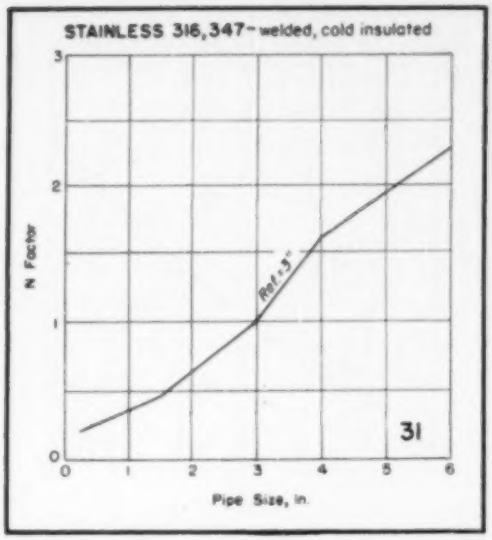



Fig. 31—STEEL, stainless, types 316, 347: Pipe, std. wt., ¼ to 6 in., insul. 0 to −25 deg. F. Fittings and valves same as Fig. 30. Insulation S.B.T. cork, 0 to −25 deg.

| | 3 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $23.05 | 1.55 | 24.60 |
| F | 33.20 | 8.40 | 41.60 |
| V | 159.00 | 10.45 | 169.45 |

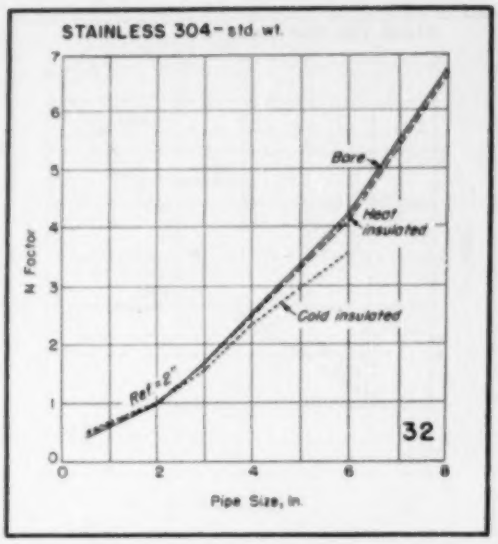



Fig. 32—STEEL, stainless, type 304: Pipe, std. wt., wld., bare and insul. F type 304 std. wt. wld. V type 304 fl. g. Ser. 15. Insul. 85% Mag. 400 deg., S.B.T. cork, 0 to −25 deg.

| | 2 in., bare | 2 in., hot | 2 in., cold |
|---|---|---|---|
| | Total[2] | Total[2] | Total[2] |
| P | $5.08 | 8.56 | 12.92 |
| F | 25.00 | 35.41 | 35.82 |
| V | 88.00 | 88.41 | 102.50 |

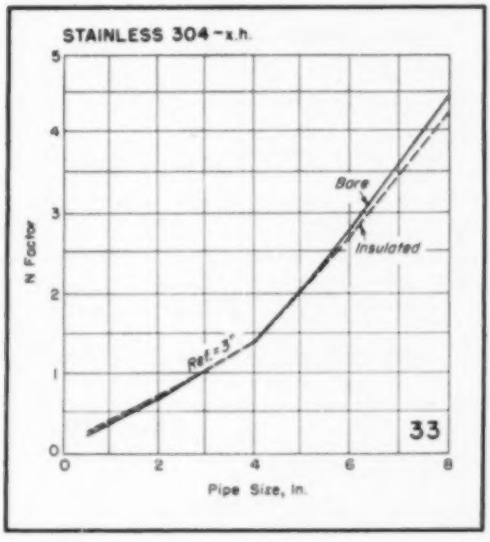



Fig. 33—STEEL, stainless, type 304: Pipe, XH, wld., ¼ to 8 in., bare and 800 deg. insul. F type 304 XH wld. V type 304 Ser. 30 fl. g. Insul. 85% Mag. and Superex 800 deg. F.

| | 3 in., bare | | | 3 in., 800 deg. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $18.07 | 0.13 | 18.20 | $19.47 | 1.33 | 20.80 |
| F | 53.50 | 7.00 | 60.50 | 54.87 | 7.34 | 62.21 |
| V | 268.00 | 16.00 | 284.00 | 267.30 | 15.70 | 283.00 |

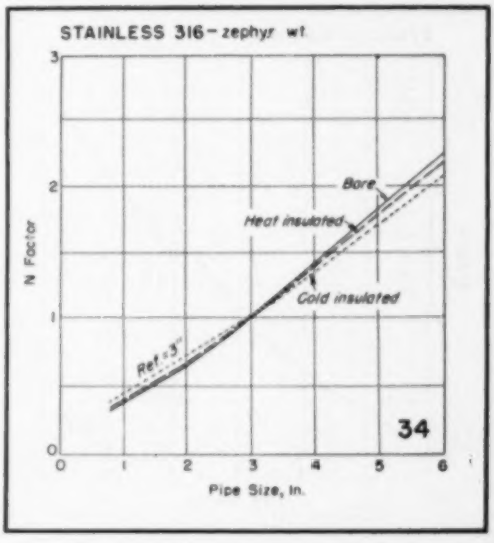



Fig. 34—STEEL, stainless, type 316: Pipe, zephyr wt. wld., ¼ to 6 in., bare and insul. F 316 zeph. wt. wld. V 316 Ser. 15 fl. g. Fl. 316 Ser. 15 wld. Insul. 85% Mag., S.B.T. cork.

| | 3 in., bare | 3 in., hot | 3 in., cold |
|---|---|---|---|
| | Total[2] | Total[2] | Total[2] |
| P | $6.19 | 7.09 | 11.64 |
| F | 13.00 | 16.10 | 32.60 |
| V | 125.00 | 120.96 | 148.45 |

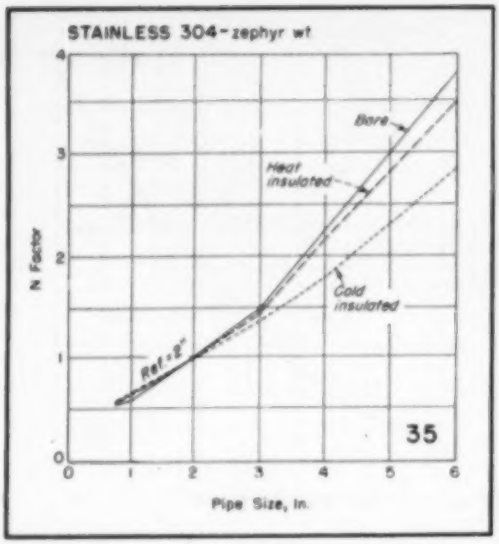



Fig. 35—STEEL, stainless, type 304: Pipe, zephyr wt. wld., ¼ to 6 in., bare and insul. Fittings, valves, flanges as in Fig. 34 except type 304. Insul. 85% Mag. and S.B.T. cork.

| | 2 in., bare | 2 in., hot | 2 in., cold |
|---|---|---|---|
| | Total[1] | Total[1] | Total[1] |
| P | $2.53 | 3.29 | 7.36 |
| F | 8.00 | 8.82 | 18.50 |
| V | 90.00 | 90.82 | 104.50 |

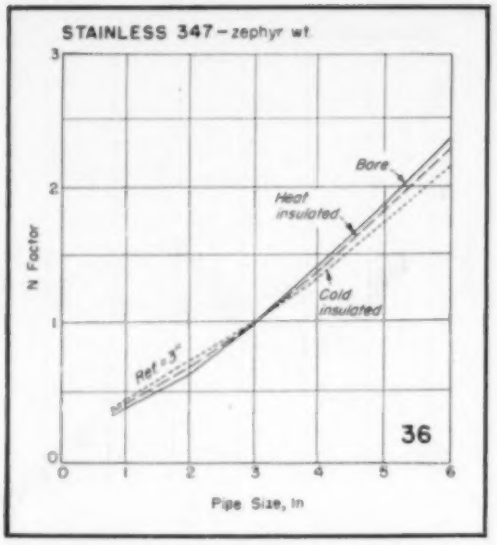



Fig. 36—STEEL, stainless, type 347: Pipe, zephyr wt. wld., ¼ to 6 in., bare and insul. Fittings, valves, flanges and insulation as in Fig. 34, except S.S. type 347.

| | 2 in., bare | 2 in., hot | 2 in., cold |
|---|---|---|---|
| | Total[1] | Total[1] | Total[1] |
| P | $5.51 | 6.41 | 10.96 |
| F | 15.00 | 15.93 | 24.60 |
| V | 125.00 | 125.98 | 148.45 |

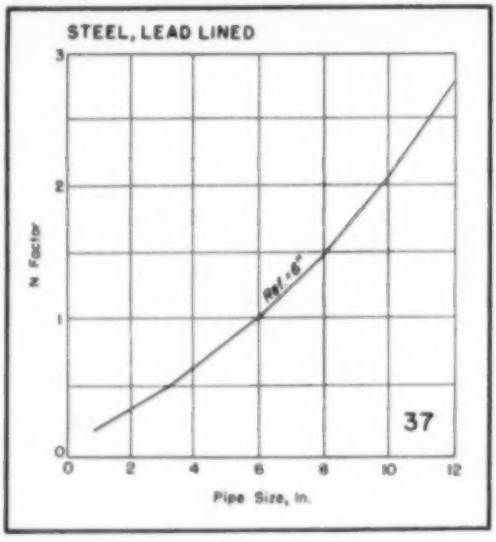



Fig. 37—STEEL, lead lined: Pipe, std. wt. homogeneous lined avg. 3/16 in. th., Fl. made on, ¼ to 12 in. F fl. stl. fl. Ser. 15. V stl. fl. g. fl. Ser. 15. Fl. stl. fl. Ser. 15.

| | 6 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $15.60 | 0.43 | 15.83 |
| F | 130.00 | 20.00 | 150.00 |
| V | 320.00 | 15.00 | 335.00 |

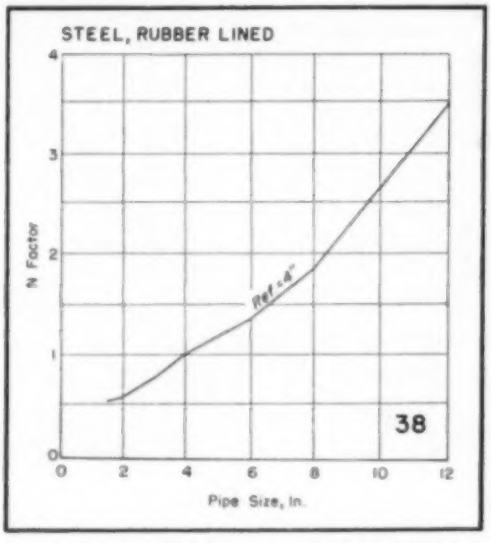



Fig. 38—STEEL, rubber lined: Pipe, std. wt. lined 3/16 in. th., Fl. made on, 1½ to 12 in. F Cl 125 lb. rl., V std. Ace rl. fl. gate.

| | 4 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $6.33 | 0.35 | 6.68 |
| F | 41.00 | 13.00 | 54.00 |
| V | 105.00 | 9.00 | 114.00 |

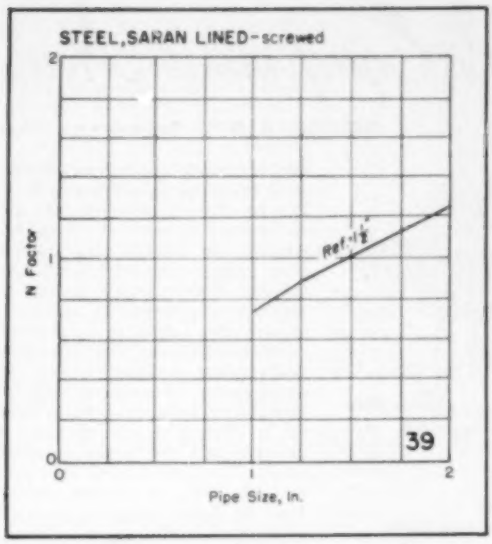



Fig. 39—STEEL, Saran lined: Pipe, std. wt. Saran lined, scr., 1 to 2 in. Fittings CI Saran lined, screwed. Valves, Saran lined stl. plug, flanged, Series 15.

| | 1¼ in. | | |
|---|---|---|---|
| | M | L | T |
| P | $2.20 | 0.11 | 2.31 |
| F | 11.00 | 2.00 | 13.00 |
| V | 60.00 | 4.00 | 64.00 |

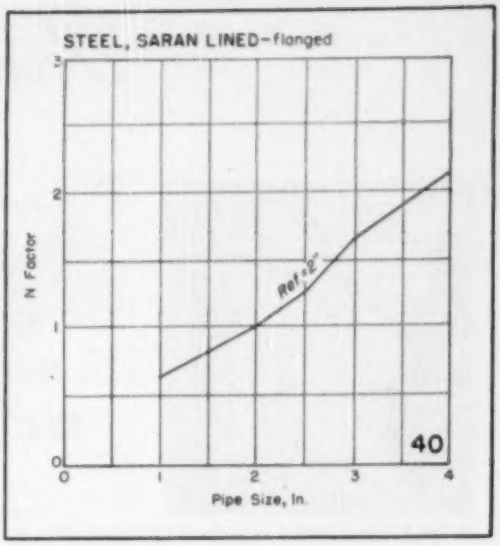



Fig. 40—STEEL, Saran lined: Pipe, std. wt. Saran lined, fl., 10-ft. lengths, 1 to 4 in. Fittings CI Saran lined, 125 lb. flanged. Valves, stl. plug Saran lined, flanged, Series 15.

| | 2 in. | | |
|---|---|---|---|
| | M | L | T |
| P | $2.80 | 0.25 | 3.05 |
| F | 25.00 | 7.00 | 32.00 |
| V | 70.00 | 6.00 | 76.00 |

(Continued from page 124)

which the N factor on the applicable chart is unity. Then the cost, in place, for any other comparable string of the same kind and class of pipe, but of a different size, is equal to the cost of the reference string times the N factor for the size in question. As an example:

Taking a cold-insulated aluminum line, as described in Fig. 2, what will be the cost of a string consisting of 500 ft. of 6 in. pipe containing four fittings and three valves, insulated for 0 to −25 deg. F.? Assume that the July 1949 data will be satisfactory without modification. Then, for the 4-in. reference size, 500 ft. of pipe plus four fittings plus three valves will come to $500 \times 9.42 + 4 \times 45.50 + 3 \times 220.75 = \$4{,}710 + 182 + 662.25 = \$5{,}554.25$. Since the N factor for the 6 in. size is 1.640, then the cost of the string in 6 in. pipe will be $\$5{,}554.25 \times 1.640 = \$9{,}109$. And that is all there is to it!

**Footnotes to cost tables**

(1) Detailed costs for Fig. 24.

| | 8 in., 400 deg. | | | 18 in., 400 deg. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $4.23 | 0.98 | 5.21 | $10.76 | 1.95 | 12.71 |
| F | 41.00 | 21.38 | 62.38 | 203.18 | 41.24 | 244.42 |
| V | 296.00 | 40.38 | 336.42 | 1,396.00 | 111.00 | 1,507.00 |

| | 8 in., 0 to −25 deg. | | | 18 in., 0 to −25 deg. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $11.53 | 4.39 | 15.92 | $23.14 | 8.83 | 31.97 |
| F | 70.50 | 32.65 | 108.15 | 267.00 | 65.75 | 332.75 |
| V | 355.00 | 62.80 | 417.80 | 1,521.00 | 152.00 | 1,673.00 |

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(2) Detailed costs for Fig. 32.

| | 2 in., bare | | | 2 in., hot | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $7.95 | 0.13 | 8.08 | $8.22 | 0.34 | 8.56 |
| F | 20.00 | 5.00 | 25.00 | 20.33 | 5.08 | 25.41 |
| V | 80.00 | 8.00 | 88.00 | 80.33 | 8.08 | 88.41 |

| | 2 in., cold | | |
|---|---|---|---|
| | M | L | T |
| P | $11.45 | 1.47 | 12.92 |
| F | 27.70 | 7.82 | 35.52 |
| V | 90.35 | 12.15 | 102.50 |

(3) Detailed costs for Fig. 34.

| | 3 in., bare | | | 3 in., 400 deg. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $6.09 | 0.10 | 6.19 | $6.43 | 0.66 | 7.09 |
| F | 8.00 | 5.00 | 13.00 | 8.50 | 5.60 | 14.10 |
| V | 115.00 | 10.00 | 125.00 | 115.80 | 10.55 | 125.95 |

| | 3 in., 0 to −25 deg. | | |
|---|---|---|---|
| | M | L | T |
| P | $9.86 | 1.76 | 11.64 |
| F | 22.00 | 10.60 | 32.60 |
| V | 131.45 | 17.00 | 148.45 |

(4) Detailed costs for Fig. 35.

| | 2 in., bare | | | 2 in., 400 deg. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $2.45 | 0.08 | 2.53 | $2.72 | 0.57 | 3.29 |
| F | 4.00 | 4.00 | 8.00 | 4.33 | 4.49 | 8.82 |
| V | 82.00 | 8.00 | 90.00 | 82.33 | 8.49 | 90.82 |

| | 2 in., 0 to −25 deg. | | |
|---|---|---|---|
| | M | L | T |
| P | $5.96 | 1.41 | 7.36 |
| F | 12.00 | 6.50 | 18.50 |
| V | 92.35 | 12.15 | 104.80 |

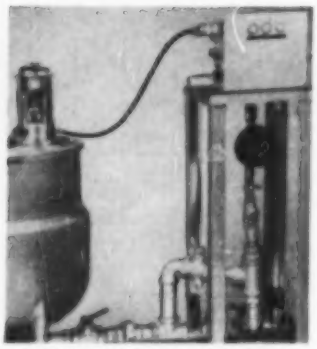
(5) Detailed costs for Fig. 36.

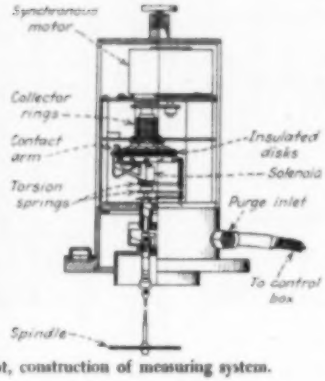
| | 3 in., bare | | | 3 in., 400 deg. | | |
|---|---|---|---|---|---|---|
| | M | L | T | M | L | T |
| P | $5.41 | 0.10 | 5.51 | $5.75 | 0.66 | 6.41 |
| F | 9.00 | 6.00 | 15.00 | 9.37 | 6.54 | 15.91 |
| V | 115.00 | 10.00 | 125.00 | 115.37 | 10.61 | 125.98 |

| | 3 in., 0 to −25 deg. | | |
|---|---|---|---|
| | M | L | T |
| P | $9.32 | 1.64 | 10.96 |
| F | 22.35 | 12.25 | 34.60 |
| V | 131.70 | 16.75 | 148.45 |

# Process Equipment News

THEODORE R. OLIVE, Senior Associate Editor






**At left, Viscotrol installed on kettle; at right, construction of measuring system.**

## Automatic Viscosity Controller Covers Range From 2 to 50,000 Centipoises

**Developed for continuous automatic control of processes in which viscosity normally varies in only one direction**

Using the same principles that have been applied successfully in its indicating portable viscometer, Brookfield Labs has developed a new continuous instrument for permanent installation on the equipment where viscosity is to be measured. This device, the Viscotrol, operates automatically and is adapted either to signalling when a certain viscosity has been reached, or to automatic control of blending or dilution operations. Used in conjunction with equipment supplied by other manufacturers cooperating with Brookfield, viscosity may be indicated or recorded, as well as controlled.

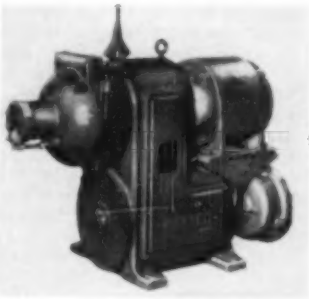
A typical installation on a kettle appears at the left above, with a diagram showing construction of the measuring portion of the instrument at the right. This is the portion shown on top of the kettle. Basically, the instrument measures the viscous drag exerted by the material on a spindle of suitable size and shape which rotates at constant speed in the material. The spindle is driven through a permanently calibrated torsion spring by means of a small synchronous motor. The retarding force caused by the viscous drag results in flexure in the spring to the point where it balances the torque imposed on the spindle. The angle of flexure is proportional to the viscosity of the material under control. The problem then becomes one of measuring the flexure in the rotating drive system in a way which will permit a high degree of measuring accuracy, and yet impose no load of its own which could introduce error.

The method used is as follows: The driving members consist of three insulated disks which are separately adjustable. Two of them serve as high and low limit controls and the third performs the normal viscosity controlling function. On its periphery is a segment of insulating material, adjacent to a segment of conductive material. Every 6 sec. a solenoid-operated contact arm which is an integral part of the spindle shaft moves inward and makes contact with one of the disks at a point determined by the angle of flexure of the torsion spring, i.e., determined by the viscosity of the material.

The point on the control disk where the insulating and conductive portions join is the control point. In normal operation the contact arm strikes either the insulating or conducting section every 6 sec. If it contacts the former, nothing happens, since the viscosity has not passed the control limit. If it has done so, however, then the conductive contact is completed (through the collector rings) which closes a double-pole relay in the control box. One relay pole is used to keep the relay locked in, while the other operates a signal, or an automatic valve, variable-speed drive, temperature regulator or other viscosity correcting device. When the viscosity has been corrected, the contact arm leaves the conducting portion, the relay is unlocked and the corrective action ceases. The limit control disks operate only when the viscosity wanders from the desired range for which the control disk is set.

The manufacturer claims the device to be accurate to 1 percent of the full range of viscosity for which it is set. The control point can easily be changed and installation is readily made on either open or pressure systems. Working parts are inclosed and air purging is possible where unusually severe conditions are met.

*Brookfield Engineering Laboratories, Stoughton, Mass.*



MAKES CONTROL AUTOMATIC:

## Hydraulic Speed Changer

Available for both new models of the No. 4000 to 7000 Reeves Motodrives, as well as for units already in service, a new hydraulic control permits speed to be adjusted accurately in proportion to any desired process variable such as tension, velocity, temperature or liquid level. The hydraulic controller, applied to the Vari-Speed Motodrive, requires an actuating force of only a few ounces to adjust the

ratio of the speed changer. This is accomplished through the use of a self-contained hydraulic power plant, a simple rotary valve, a piston and a cylinder in a streamlined case, which is mounted on the Motodrive in place of the customary hand wheel. If desired, the same unit can be employed without the hydraulic power plant for pneumatic operation from any suitable compressed air supply.

The control unit incorporates a follow-up action so that each position of the valve lever corresponds to a definite speed which will be held exactly until automatically or manually changed. The control lever directs the flow of oil into a cylinder, regulating the position of a piston which changes the ratio of driving to driven pulley diameters and therefore changes the output speed of the unit.

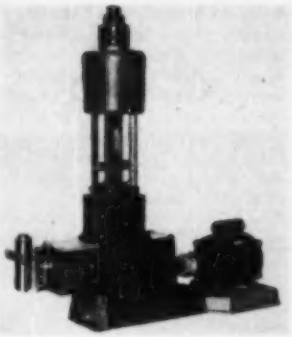
*Reeves Pulley Co., Columbus, Ind.*

CORROSION RESISTANT:

### Plastic Pipe

Developed especially for handling water, but also suitable for many cold chemical handling applications, as well as for the piping of gases, a new plastic pipe designated at Carlon EF has been introduced by Carter Products. The pipe is said to be practically unbreakable, having impact characteristics at temperatures from −50 to +140 deg. F. similar to soft rubber. The plastic has a tensile strength of 1,400 psi. and good insulating qualities which prevent any possibility of electrolytic corrosion. The pipe is light in weight, flexible, and easily jointed. A 25-ft. length of 6 in. pipe, for example, weighs only about 55 lb. Since the pipe can be curved to follow a ditch line or surface contour, many fittings are eliminated. What fittings are necessary are applied with stainless steel clamps and are available from stock in all sizes from ½ to 6 in.

*Carter Products Corp., 10187 Meech Ave., Cleveland 5, Ohio.*



CONTROLS OUTPUT:

### Proportioner Accessory

To provide automatic control of the output of its Pulsafeeder proportioning pumps by means of a variety of different kinds of pneumatic control instruments, Lapp has developed an accessory known as the "Auto-Pneu-Matic" control. The company's proportioning pumps are equipped with a feature permitting their output to be adjusted while in operation. Manually, this is accomplished by operating a hand wheel. With the new Auto-Pneu-Matic control, by replacing the hand wheel, automatic volume change from zero displacement to full displacement can be made in response to instrument air pressure changes. The device can be used on all models of this company's proportioning pumps, for control by any commercial pneumatic system. It makes possible pump output response to any measurable variable such as flow, pH, temperature change, liquid level, pressure, or the like.

*Lapp Insulator Co., Process Equipment Division, LeRoy, N. Y.*

INTERMEDIATE RANGE:

### High Vacuum Gage

To improve vacuum gaging in the intermediate range between gages for extreme high vacuum, and present dial-type measuring instruments,

(*Continued*)

## This Month . . .

Well, back to normal, now that some 46,000 engineers have completed their biennial pilgrimage to the New York Chemical Show. Incidentally, we were quite set up to find how close we came to keeping you informed on all the most important developments in process equipment. Those we found at the Show that had been missed will come along in due course, this month or next. And now, some high-lights in the later pages . . . You'll say, "Why didn't somebody think of that before?" when you see the fork truck that *lowers* rather than elevates, on page 138 . . . And there is an interesting new angle in cold process water softeners on page 140 . . . If you are high-temperature minded, see the new wrinkle in Dowtherm heated kettles on page 143 . . . And the scheme for grounding personnel, on page 144 will hit you if you have a static hazard.

## Next Month . . .

Come February we guarantee a new crop of good equipment ideas. To mention just a few . . . look for a story on an indicator for solids flow . . . and another on a new idea in mills for extremely fine grinding. Instruments? Yes, several, including a new atmospheric pollution meter . . . and something novel in weighing machines.

### Marshall and Stevens Indexes of Comparative Equipment Costs

(1926 = 100)

Compiled quarterly for March, June, September and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see B. W. Stevens, **Chemical Engineering**, Nov. 1947, pp. 124-6. For a listing of annual averages since 1913 see **Chemical Engineering**, Feb. 1949, p. 129.

| Industry | Dec. 1948 | Sept. 1949 | Dec. 1949 |
|---|---|---|---|
| Average of all | 166.6 | 159.6 | 159.4 |
| **Process Industries** | | | |
| Cement mfg. | 159.8 | 155.9 | 155.3 |
| Chemical | 167.8 | 163.4 | 163.3 |
| Clay products | 154.8 | 150.4 | 150.3 |
| Glass mfg. | 157.9 | 153.5 | 153.4 |
| Paint mfg. | 161.1 | 156.7 | 156.6 |
| Paper mfg. | 161.4 | 157.0 | 156.9 |
| Petroleum ind. | 164.2 | 159.8 | 159.7 |
| Rubber ind. | 166.6 | 162.2 | 162.1 |
| Process ind. avg. | 165.2 | 160.9 | 160.7 |
| **Related Industries** | | | |
| Elec. power equip. | 169.4 | 165.0 | 164.9 |
| Mining, milling | 168.5 | 164.1 | 164.0 |
| Refrigerating | 181.3 | 173.9 | 173.6 |
| Steam power | 156.5 | 152.1 | 152.0 |

Stokes has developed a new McLeod type gage with a working range of 0.05 to 50 mm. The gage is said to be easily and quickly operated for rapid readings, giving excellent performance in applications subject to excessive contamination during operation. It is light in weight, weighing only 6¼ lb., and is housed in a plastic case. It is furnished complete with 1 lb. of mercury necessary for filling the gage system.

*F. J. Stokes Machine Co., 59 Tabor Road, Philadelphia 20, Pa.*

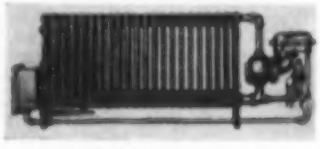
AIR-OPERATED:

## Automatic Drum Filler

Because it is air-operated, a new automatic drum filling system developed by Yale & Towne eliminates fire and explosion hazard in automatically cutting off the flow of an explosive liquid that is being weighed.

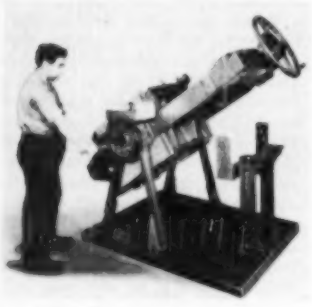
The system is completely mechanized and is said to weigh any sort of liquid such as oil, paint, acetate solutions or carbon tetrachloride, with an accuracy of 6 oz. in filling a standard 52-gal. drum. The automatic air-operated filling device will fill any size container from 1 qt. up. It is said to reduce handling time since one man alone can do the whole job of filling and weighing, with little expenditure of physical effort. An important feature is the automatic air-operated tare adjustment. Only the first drum of a sequence to be weighed requires that the tare beams be set manually for the net amount of liquid to be stored in the container. After that, the varying weight of the second and each succeeding drum is quickly offset by a lever which operates the air-operated tare control. It is then merely necessary to press a button to fill the drum, the filler mechanism shutting off automatically at the proper weight.

*The Yale & Towne Mfg. Co., Philadelphia Division, Philadelphia, Pa.*



## HEATER FOR EXPLOSIVE ATMOSPHERES

**Burnham Corp.'s latest development is an explosion-proof electric radiator approved by Underwriters Laboratories for use in Class 1-Group D atmospheres as well as Class 2-Groups F and G atmospheres. The heat transfer medium is a sealed-in water solution of ethylene glycol. All switches and connections are sealed in heavy cast iron housings. Automatic pressure control is provided.—Burnham Corp., Electric Radiator Dept., Irvington, N. Y.**



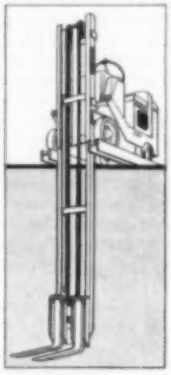
BASES CLEANING:

## Tilting Filter Press

To facilitate filtrations which are improved by using filtering surfaces in a horizontal position, but to allow cleaning the plates in the usual vertical position, Shriver has developed a simple arrangement for tilting an otherwise standard filter press. In this arrangement filter aids and cake constituents flow evenly to deposit a uniform cake over the filter surface when the press is in the tilted position. The cake will not be disturbed should the flow of feed be cut off at any time. Intermittent filtration does not disturb either the filter aid precoat or the filter cake proper. However, when the filter is to be cleaned, the press can be tilted back to its normal position, with the plates and frames vertical, and the usual procedure for cleaning and reassembly easily followed.

To accomplish this, a worm and worm wheel assembly is provided to tilt the press by turning a crank handle. The unit shown is a 24-in. washing type stainless steel filter with joint surfaces grooved to connect with an eye for prevention of external leakage. Filtration, washing and air drying of the cake can be carried out in the normal manner.

*T. Shriver & Co., Harrison, N. J.*



ADDS NEW DIMENSION:

## Elevator Truck

A new dimension in fork truck potentialities was added recently by Towmotor in developing a special "elevator" truck for a manufacturer of glass containers. The bottle making machines were located on the ground floor, while the various molds and fixtures were stored on a balcony. By running a track of steel H-beams out from the balcony alongside each machine, it was possible to drive a special modification of this company's standard Model LT-40 lift truck on to the truck above the desired location. The truck was provided with a narrow, non-tilting mast designed to permit the forks to be lowered 98 in. below the balcony floor level, or raised 10 in. above. Loads picked up on the balcony can thus be lowered to the machines, or returned to the balcony when necessary. Since the mast and forks are narrow, the load is lowered between the tracks.

*Towmotor Corp., 1226 East 152nd St., Cleveland 10, Ohio.*

LOW PRESSURE OPERATION:

## Standard Oxygen Plant

Following its development of custom-built oxygen plants in sizes up to 1,000 tons per day, Stacey-Dresser has now developed a standard plant which produces a total of 10 tons per day of $O_2$ at 95 percent purity, or 10.5 gross tons per day, using normal atmos-

(*Continued*)

*The Accumulator operates to maintain constant boiler pressure while delivering steam at constant pressure to the process system despite widely fluctuating demands. Thus, in effect, the Accumulator functions as a "thermal flywheel".*

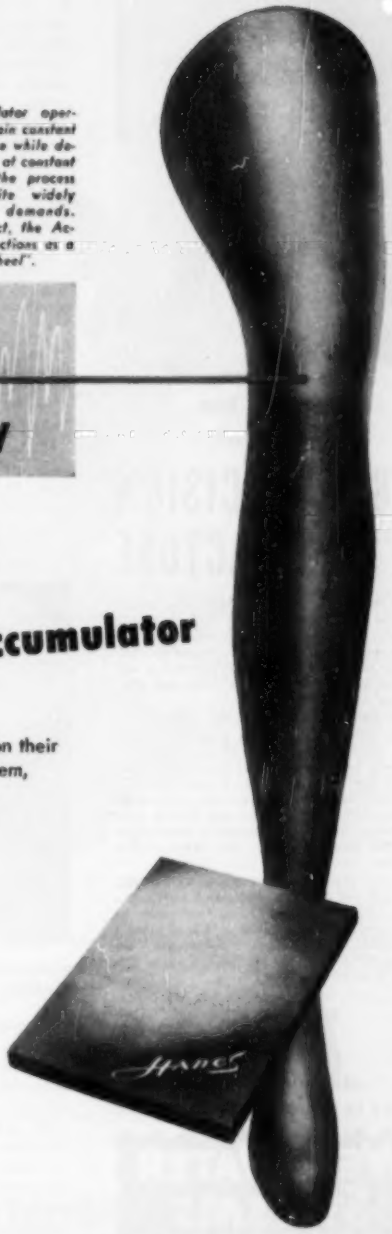
## a balanced steam supply

**problem of variable process steam demand solved at HANES HOSIERY MILLS with a**

# Foster Wheeler Ruths Accumulator

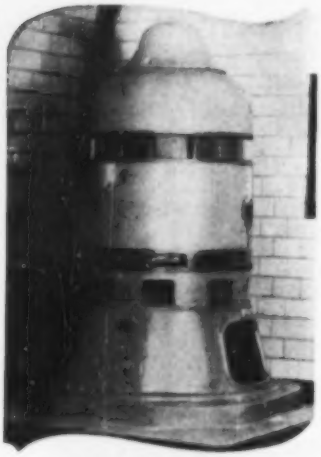
In order to smooth out uneven and intermittent demands on their steam generators, the Hanes Hosiery Mills at Winston-Salem, N. C. have installed a Foster Wheeler Ruths Accumulator which insures greater boiler room economy and permits full use of the company's preboarding operation, previously limited because of insufficient steam supply.

Nylon is a plastic and consequently must be set in preboarding machines with live steam to render it stable. In operating a large battery of preboarding machines the steam load fluctuates greatly—a heavy load one minute, no load the next. This fluctuating load is very hard on boilers unless there is much excess capacity. A Ruths Accumulator placed between the boilers and the preboarding machines levels out this load by meeting the fluctuating load of the preboarding machines while drawing a constant even load from the boilers.




**FOSTER WHEELER CORPORATION**
165 Broadway New York 6, New York

FOSTER WHEELER



**What's the value of**

# HIGH PRECISION IN MANUFACTURE

Precision is a very important requirement by the Layne organization. It is the only feature that can adequately support skilful engineering and top quality materials. The results of high precision are,—smoother operation, greater quantities of water and lower upkeep cost.

All well water systems are complicated under ground construction projects that require much more than ordinary skill. Fortunately Layne has an abundance of real "know how" that came from years of world wide experience. When they plan a well water system, furnish the pumps and do the work complete, you get a thoroughly dependable job that provides years and years of fine service.

If your plans call for more water in 1950, why not call in Layne first, and obtain the value of their proved "know how" and the satisfaction of dealing with a firm of highest reputation. For catalogs bulletins etc., address LAYNE & BOWLER, INC., General Offices, Memphis 8, Tenn.

**LAYNE**

BUILDERS OF HIGH EFFICIENCY

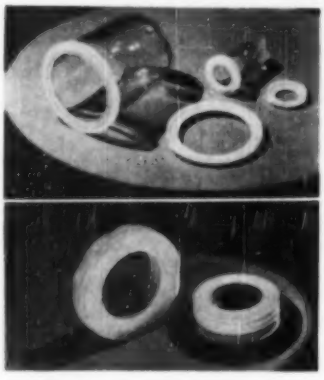
**WELL WATER SYSTEMS**

ASSOCIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. • Layne-Atlantic Co., Norfolk, Va. • Layne-Central Co., Memphis, Tenn. • Layne-Northern Co., Mishawaka, Ind. • Layne-Louisiana Co., Lake Charles, La. • Louisiana Well Co., Monroe, La. • Layne-New York Co., New York City • Layne-Northwest Co., Milwaukee, Wisc. • Layne-Ohio Co., Columbus, Ohio • Layne-Pacific, Inc., Seattle, Wash. • The Layne-Texas Co., Ltd., Houston, Texas • Layne-Western Co., Kansas City, Mo. • Layne-Minnesota Co., Minneapolis, Minn. • International Water Corporation, Pittsburgh, Pa. • International Water Supply, Ltd., London, Ont., Can. • Layne-Bluemel Americana, S. A., Mexico, D. F. General Pitter Company, Ames, Iowa.


phere clean air as the raw material. The unit is small and compact, requiring a floor space of only 32x24 ft. Since the piping is prefabricated, and there are only five pieces of equipment outside of the cold box, the unit is simple to erect. The cold box is 10x8x32 ft. and this incloses three-quarters of the fractionating tower and all the exchangers and cold piping. Except for foundations and any shelter needed for equipment outside the cold box, the total weight of the plant is only 80,000 lb.

The unit is said to be easy to maintain, with only two pieces of running equipment, as well as easy to operate. No chemicals are required, shut-downs for defrosting are unnecessary, and low oxygen cost is said to be achieved through the use of an economical low-pressure process. The only services required are water, low pressure steam and electricity.

*Stacey-Dresser Engineering Division, Stacey Bros. Gas Construction Co., 1900 Superior Ave., Cleveland 14, Ohio.*



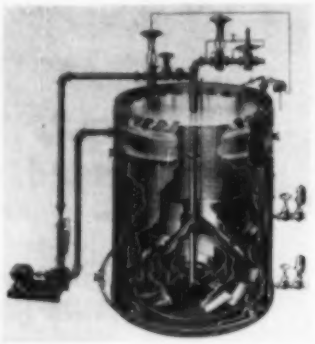
NON-CORRODABLE:

## Teflon Applications

Continuing its rapid development of applications for Teflon chemically inert plastic, U. S. Gasket has announced several new designs including self-centering snap-on gaskets for use with glass pipe, as shown in the upper illustration. These gaskets are designed to accommodate deflection and misalignment in assembling sections of conical end glass pipe. Another development is a corrosion-proof expansion joint made of Teflon diaphragms in the form of a bellows-like structure, as in the second illustration.

The company has also announced adapters for producing a mechanically perfect seal between glass-coated steel pipe, and vessels of any material, also employing Teflon. In this case the Teflon is formed into a jacket over resilient material. Still another development is an improved shaft packing made of alternating rings of Teflon and graphite or mica combined with Teflon. The solid Teflon rings are provided to preclude the possibility of flow through the packing itself. These products are suitable for temperatures as high as 500 deg. F. and down to −150 deg. F.

*United States Gasket Co., 602 North 10th St., Camden, N. J.*



COLD PROCESS:

## Water Softener

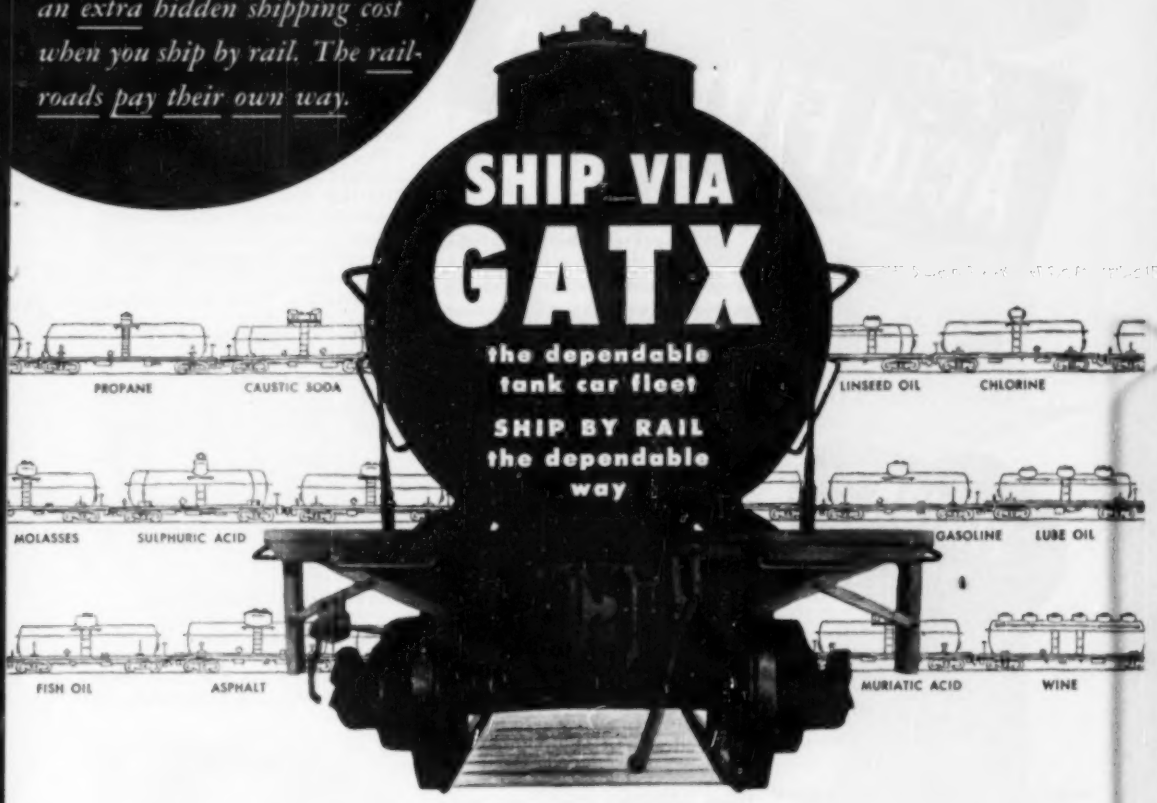
Worthington's cold slurry type softener and coagulator, a new development, is said to achieve optimum flocculation without submerged mechanical moving parts within the softener. Furthermore, maintenance of uniform depth and density of the slurry bed is said to be independent of the load on the plant. All water enters the unit through a central pipe, issuing through jets within a unit known as the Vortexor, producing rapid rotation and a general horizontal rotation of all water in the mixing chamber. This action also draws water from below through the central "eye" of the Vortexor. Up to eight volumes of water may thus be recirculated for each volume being treated.

A proportioning meter in the raw water supply introduces chemicals for treating the water in proper proportion within the conical mixing chamber. Here rapid circulation assures quick mixing with both the raw water and a part of the previously formed precipitate. Flow is then upward through a rotator which insures homogeneity of the slurry bed. Here vanes impart a gentle horizontal rotation to the slurry bed and prevent possible short circuiting. Flow then passes a constriction which acts as a slurry concentrator, above which the solids

(*Continued*)

# SHIP BY RAIL

*Your tax money does not become an extra hidden shipping cost when you ship by rail. The railroads pay their own way.*




Among the more than 200 types of GATX tank cars, there's a specialized car for taking every type of bulk liquid everywhere the railroads go. These cars are built in General American's own plants to specifications which reduce customers' handling costs and shipping time.

To keep the 41,000 GATX cars rolling, a network of completely equipped General American maintenance shops is in operation. A GATX car is never more than a few hours away from servicing.

No capital investment is needed to use this fleet. All cars are *leased* to meet shippers' special requirements. See your nearest GATX representative for details.

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# for Acid Filtration

**These synthetic fiber filter cloths, within the indicated temperature ranges, afford excellent resistance to mineral acids or alkalies even where strong concentrations are encountered. And, in addition, they are . . .**

**Unaffected by alcohols, glycols and aliphatic hydrocarbons**

**Unaffected by molds, fungi or bacteria**

**Easy to install**

**Easy to clean**

**VINYON*** . . . up to 150° F.

**VINYON N*** . . . from 150° F. to temperatures above the boil.

**NFM VINYON* and VINYON N* Filter Fabrics are available in any desired width from 26" through 72" in a wide variety of weaves and weights; also available as prepared filter element covers for all standard filters.**

**These VINYON* Cloths are suggestions. Why not call on our forty years of industrial filtration experience in connection with the selection of your filter cloths? We offer, in addition to the VINYONS*, other cloths, including Nylon, Glass, Cotton, Saran and ORLON†, an acrylic fiber cloth. You will find that we have the *right* cloth for your requirements.**

**Technical data and test samples on request. No obligation, of course.**

†T.M. E.I. duPont de Nemours & Co. (Inc.)
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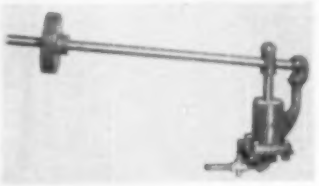
are withdrawn through a sludge-removal pipe to waste. Softened water is withdrawn at the top after overflowing a weir. If desired, this water can be filtered. In that case, an annular chamber below the draw-off launder provides a storage for back-wash water for the filter. The back-wash water, carrying sediment from the filter, returns tangentially into the bottom of the unit for recovery.

To maintain proper velocities in the slurry bed and Vortexor, regardless of withdrawal rate, a recirculating circuit is provided, shown at the left in the illustration, which recirculates treated water in inverse proportion to the treated water demand.

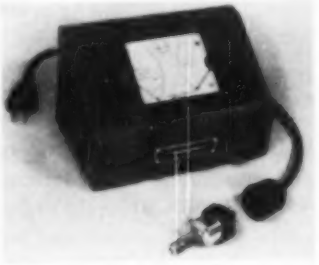
*Worthington Pump & Machinery Corp., Harrison, N. J.*



WEIGHT-LOADED:

## Automatic Lubricator

Lubrication of stuffing boxes of pumps and mixers, as well as motor and engine bearings and other lubricated equipment, is the function of

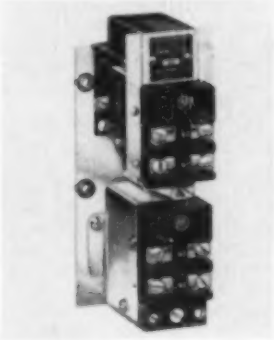


GAGES VACUUM TO 1,000 MICRONS

Using a noble-metal thermopile in a bridge circuit similar to that used in the company's precision air meter, Hastings has developed a vacuum gage for measurement in the range from 1 to 1,000 microns. The gage unit proper screws into a ¼ in. tapped hole in the vacuum system. Calibration is unaffected by connecting cable length, thus permitting remote indication. The unit operates on 115 volts a.c. It is suitable for such high vacuum operations as vacuum distillation and dehydration. — Hastings Instrument Co., Hampton, Va.

a new weight-loaded lubricator developed by Mixing Equipment Co. The lubricator can be used to deliver either oils or greases at constant pressure in any desired quantity. Weights of different values may be used and adjusted infinitely throughout the length of the lubricator arm. Thus any pressure up to 150 psig. may be employed, or even higher pressures by adding additional weights. The grease cup has a capacity of 7½ oz. of lubricant. An important advantage of the new design is that the position of the lubricator arm gives an exact indication of the amount of lubricant remaining in the cup.

*Mixing Equipment Co., 1024 Garson Ave., Rochester 9, N. Y.*



EASILY ADJUSTABLE:

### Timing Relay

In line with the current interest in fully automatic plants, Allen-Bradley has brought out a new pneumatic timing relay designated as Bulletin 849. The range is easily adjusted from 10 cycles to 3 min., with an accuracy of plus or minus 10 percent. A synthetic rubber bellows is used for controlling the tripping time. The relay employs quick make and break double-pole silver alloy contacts, one set normally open, one set normally closed. Additional contacts for pilot control can also be provided. The unit can readily be changed from "on-delay" to "off-delay" operation.

*Allen-Bradley Co., Milwaukee, Wis.*

SELF-CONTAINED:

### Dowtherm Kettle

Groen's new gas-fired, Dowtherm-heated processing kettle is a completely self-contained unit, charged at the factory with the correct quantity of Dowtherm, after which the Dowtherm chamber is evacuated and hermetically sealed. There is no separate Dowtherm vaporizer, no external

(Continued)

# May we assist you, sir?

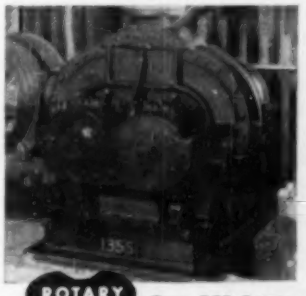
**If you're on a merry-go-round about handling air or gas, *R-C dual-ability* can help you.**

That's been our exclusive job for almost a century. We've developed the most extensive line of blowers, exhausters and gas pumps in the industry, with capacities from 5 cfm to 100,000 cfm.

We're the only builders offering that *dual choice* of both Centrifugal and Rotary Positive equipment. Thus, without bias, we can suggest units that meet most closely the requirements of the work to be done.

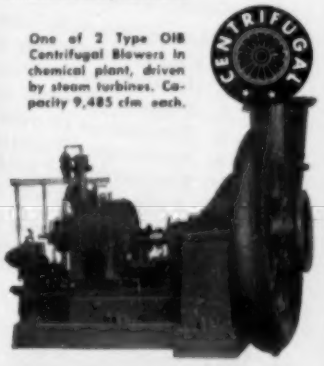
For new installations or replacements, look to us for your needs. Alert engineering teams up with modern construction to insure long-time, satisfactory performance of R-C equipment.

ROOTS-CONNERSVILLE BLOWER CORPORATION
501 Illinois Avenue, Connersville, Indiana



ROTARY

Type RCD Rotary Positive Blower for chemical processing, with capacity of 300 cfm, V-belt driven by motor.



CENTRIFUGAL

One of 2 Type OIB Centrifugal Blowers in chemical plant, driven by steam turbines. Capacity 9,485 cfm each.

ROOTS-CONNERSVILLE

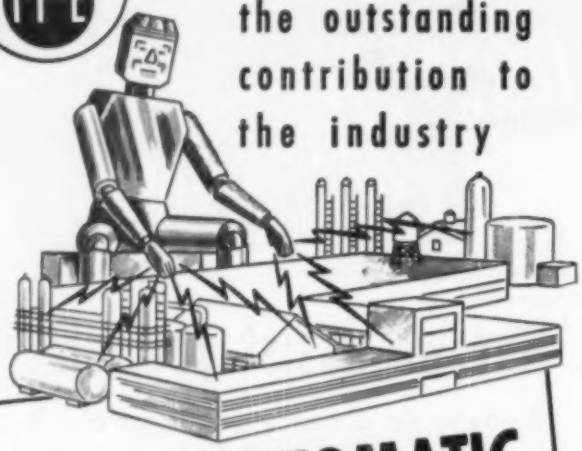
BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES

I·P·E

*Announces...*

**the outstanding contribution to the industry**



**Completely AUTOMATIC PROCESSING PLANTS**

A giant step beyond conventional automatic process-variable control, I•P•E Robotization creates a plant which is set in motion, scheduled for daily output, and regulated by two master control switches. All other plant operations are performed by standard control instruments integrated with highly engineered systems of electronic and pneumatic inter-locks.

For existing plants and processes and for those in the design stage I•P•E Robotization offers these positive advantages:

1. Lowest possible labor costs
2. Highest attainable product quality
3. Uniform and continuously reproducible results
4. Greatest possible savings of raw material
5. Elimination of possible human error
6. Maximum efficiency in use of utilities
7. Elimination of breakdown due to overloading
8. Automatic checks on instruments

Requests for informative discussion, authoritative literature, actual proposal, or any additional information will be promptly honored.

Address Process Plant Division

I·P·E ENGINEERS DESIGNERS MANUFACTURERS ★ INDUSTRIAL ★ PROCESS ENGINEERS

*2 Lister Avenue, Newark 5, N. J.* *Branch Offices in Principal Cities*



piping except for gas supply and process piping, and no Dowtherm pump. The lower part of the unit consists of a gas combustion chamber provided with a ring type burner. This chamber is surrounded on all sides except the bottom by a Dowtherm jacket which holds a supply of liquid Dowtherm. Above the liquid Dowtherm surface is the kettle proper, surrounded by a Dowtherm vapor jacket. The whole is then insulated.

Kettles are of stainless steel, in capacities from 60 to 500 gal. They are provided with a turbine-type agitator and with two mixing baffles adjustable from the outside, through which water can be circulated for cooling. If desired, electric heating can be substituted for the gas heating arrangement. Both types are provided with thermostatic control of the heat supply, with automatic cooling included in the temperature control setup, if desired.

The same concern has also introduced a new multi-purpose cartridge-type filter unit available in various metals. Produced in sizes from 6 to 180 sq. ft. of filtering area, the unit comprises a filter tank containing the all-metal filter units, a feed tank for preparing the precoat and holding the slurry to be filtered, a circulating pump, and the necessary piping. The assembly is mounted on a frame supported on castors for portability.

*Groen Mfg. Co., 4539 West Armitage Ave., Chicago 39, Ill.*

ELIMINATES STATIC:

**Personnel Grounder**

Called the Nostat, a new Legge anti-static device is said to provide a sure ground between plant personnel and conductive floors. Although a conductive floor can absorb and carry off static charges properly connected to it, the shoe soles and socks of personnel may give sufficient insulating ef-

fect to permit the bodies of operatives to build up high potential static charges. The new device consists of a garter making contact with the skin, connected by a flexible bead chain through a spring to a brass shoe clip containing a retractible floor contact pin. A resistor is included in the connection from garter to contact.

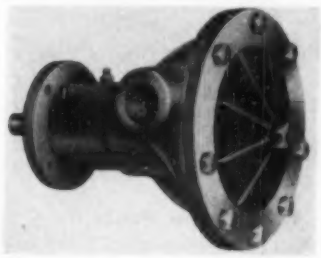
*Walter G. Legge Co., Architects Building, 101 Park Ave., New York 17, N. Y.*

ACCURATE, RELIABLE:

## Recording Vacuum Gage

Through circuit modifications in its standard Alphatron cold-emission ionization gage, National Research has been able to combine this instrument with a Brown Electronik recorder to record continuously total pressure in the range from 1 micron to 10 mm. Hg. The instrument gives continuous linear response to total pressure. Ionization is provided by means of alpha particles emanating from an inclosed radium source. The recorders available give full-scale sweeps of 24, 12 or 4½ sec. so that the device can be used either for slowly changing pressures or rapidly fluctuating pressures. Recording can be in any of three ranges of 0 to 0.1 mm., 0 to 1 mm., or 0 to 10 mm. If desired, the recorder can be of the controlling type.

*National Research Corp., Cambridge 42, Mass.*



PULSATIONLESS:

## Rotary Pump

An improved design of positive displacement rotary pump incorporating a new method of actuating the radial vanes, which serve as the pumping elements, has been brought out by Chicago Laboratory & Engineering Co. The pump is of the type with an eccentric cylindrical rotor, rotating within a cylindrical casing, sealing being effected by four radial vanes. However, the vanes are controlled both radially and laterally in such a way that they "float" within the working chamber, without touching either the sides or the race as they revolve.

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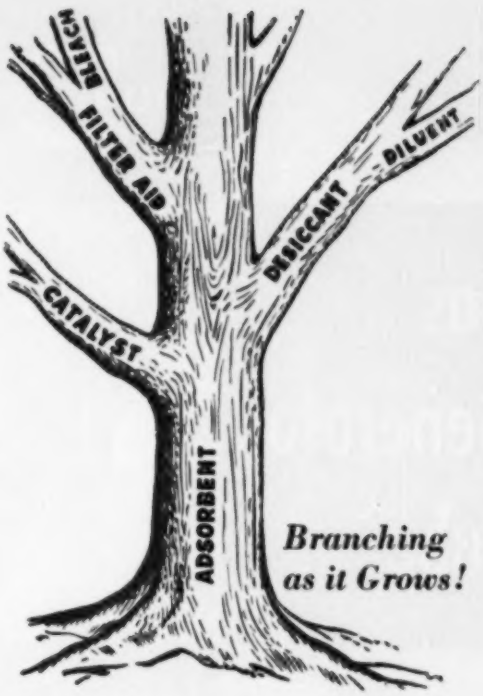


*Branching as it Grows!*

**FLORIDIN Fullers Earth**

**introduced by the Floridin Company almost a half-century ago as a superior adsorbent for removing tars, gums, color bodies, etc., from petroleum oils .....**

**Has gradually extended its usefulness to the benefit of various industries.**

**The Floridin catalog now offers more than a score of different products of Fullers Earth and Activated Bauxite for the requirements of ....**

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| Oil Refining | Pipe Line Drying |
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Water Treatment
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*Specify —*

**FLORIDIN**
**Fullers Earth - Activated Bauxite**
**PRODUCTS**

**FLORIDIN COMPANY**
ADSORBENTS

Dept. A, 220 Liberty St., Warren, Pa.

DURASPUN

Gas Generator Tube...

30% Cr — 20% Ni

This tube is made up of three centrifugally cast sections, each about 9 feet long and welded together to make a total length of some 27 feet. The wall thickness is ½ inch.

Centrifugally cast alloy steel is exceptionally uniform, strong and close-grained. More and more it is being used for process work where high strength and safety coupled with heat or corrosion resistance are required. And a big share of the industry's centrifugal casting tonnage is coming from the same Duraloy high alloy foundry that produced this gas generator tube.

How about making Duraloy your source of supply for chrome iron, chrome nickel or nickel chrome castings — centrifugal or static? We have the experience.

THE DURALOY COMPANY

Office and Plant: Scottdale, Pa. • Eastern Office: 12 East 41st Street, New York 17, N. Y.

Detroit
F. B. CORNELL & ASSOCIATES



The control mechanism is inside of and revolves with the rotor, and consists in forming the center portion of each vane into a yoke construction which centers the vanes in the working chamber through action of a crosshead concentric with the casing. Lateral control is accomplished by locking the vanes inside of the rotor.

This construction is said to result in minimum wear and extremely quiet operation under all loads, without vibration or pulsation. These pumps are produced in the 1-in. size for maximum pressures of 50, 60, or 70 psig., and deliveries of 10 to 20 gpm. Construction materials include all cast iron, cast iron with bronze fittings, and all bronze. An important feature is a new mechanical seal effective against either pressure or vacuum. Pumps are self-priming and can handle light or heavy liquids, operating equally well in either direction of rotation.

*Chicago Laboratory & Engineering Co., 4140 North Kedzie Ave., Chicago 18, Ill.*

PROTECTS GAGES:

## Diaphragm Seals

Nine types of diaphragm seals for the protection of any make of pressure instrument are now being offered by Mansfield & Green. These seals are intended to protect instruments subject to corrosion, and to avoid their clogging. They are made in two general types, a plain type for non-clogging corrosive service, and a clean-out type for clogging service. In these devices a thin flexible diaphragm made of a suitable metal to resist the corrosive service is exposed to the process pressure. This pressure is transmitted to the gage by a solid liquid fill on the other side of the diaphragm. The standard line is suitable for pressures to 600 psi. or 2,000 psi., depending on type. Units

(Continued)

# Bagpakers

designed and serviced by the manufacturer of BAGPAK Multiwall Bags

**Who but a manufacturer of multiwall paper bags is best equipped to design and service bag packaging machinery?**

Automatic advantages of faster, more efficient packaging come with automatic BAGPAKERS . . . that's why we say —

**if you want** a packaging machine that sews a multiwall tighter and faster — rely on a BAGPAKER . . .

**if you want** an automatic machine that weighs, fills, settles and seals better — rely on BAGPAKER . . .

**if you want** a real performer — a dependable machine that boosts and maintains production rates — rely on BAGPAKER.

*BAGPAKERS and Bagpak Multiwall Bags are ideal for packing food, chemicals and fertilizers. Write for our booklet 200B—it will give you added information on these money- and labor-saving machines and multiwall bags.*

BAGPAK DIVISION

**INTERNATIONAL PAPER COMPANY, Bagpak Division**
220 East 42nd St., New York 17, N. Y.

BRANCH OFFICES: Atlanta, Baltimore, Boston, Chicago, Cleveland, Baxter Springs, Kansas, Los Angeles, New Orleans, Philadelphia, Pittsburgh, St. Louis, San Francisco.

In Canada: Continental Paper Products, Ltd., Montreal, Ottawa.

At Personal Products Corporation, this "C-J" Pangborn Dust Collector eliminates need for an extra boiler and recovers a ton of valuable material every eight hours!

# How PANGBORN DUST CONTROL SAVES WINTER HEATING COSTS for Personal Products Corporation

PANGBORN Dust Control *does more* than stop dust, *does more* than recover valuable material at Personal Products Corp. The way E. W. Jochim, manager of Personal's Chicago Plant, figures . . . Pangborn Dust Control saves the *cost of an additional boiler!*

Here's how:

With an ordinary system, dust laden air at the Chicago Plant would be exhausted outside. In winter, *35,000 cubic feet of precious heat a minute,* as well as dust, would be thrown away. An extra boiler for *heating alone* would be needed to make up the heat loss!

But with Pangborn Dust Control, *there is no heat loss!* In winter, heated factory air is *so clean* it can be recirculated throughout the plant. There is no need for an extra boiler . . . the dust problem is solved and *a ton of valuable material recovered every eight hours!*

**How much can you save?**

Just like Personal Products, chances are you can *save money* in more ways than one with Pangborn Dust Control. Find out now . . . a free Pangborn Dust Survey costs you nothing, carries no obligation. Get the details; write for Bulletin 909A to: PANGBORN CORPORATION, 283 Pangborn Blvd., Hagerstown, Maryland.

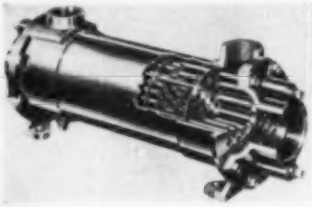
*Look to Pangborn for the Latest Developments in Dust Control and Blast Cleaning Equipment*

STOP THE DUST HOG from stealing profits with **Pangborn** DUST CONTROL


NEW EQUIPMENT, cont. . .

for pressures to 5,000 psi. are made for special applications.

*Mansfield & Green, 1051 Power Ave., Cleveland 14, Ohio.*

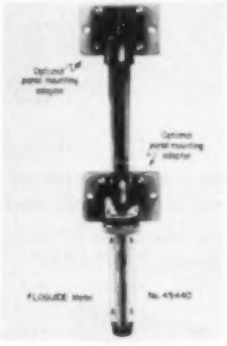


STANDARD DESIGN:

## Stainless Exchanger

Recently announced by Ross Heater is a new all-stainless steel heat exchanger, said to be the first of its type to reach mass production. Through complete standardization and the stocking of all component parts, the company claims immediate delivery and low unit cost on this model. Designated as Type SSCF, the new exchanger is identical in design and capacities with the company's Type BCF all-copper and copper-alloy exchangers. It is offered in a complete range of sizes, tested to 450 psi., available regularly in Type 316 stainless. Such exchangers can, however, be made of other well-known stainless types also.

*Ross Heater & Mfg. Co., 1407 West Ave., Buffalo 13, N. Y.*



DESIGNED FOR GASES:

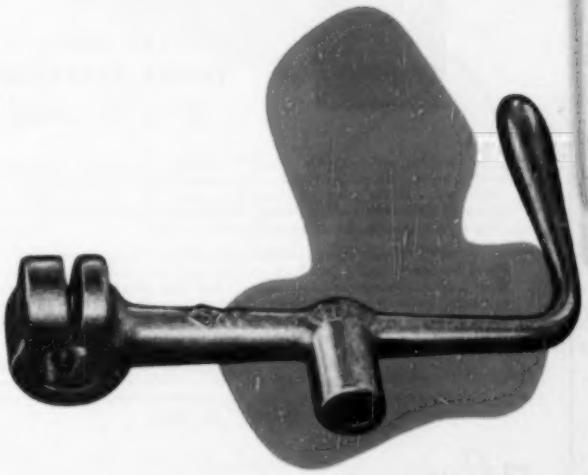
## Area Flowmeter

Most recent development of the Fischer & Porter line for metering of gases is a variable-area flowmeter known as the Floguide. The metering element or "float" rides in a tapered precision-bore metering tube of stainless steel. Below the gas inlet

(Continued)

# MANY HANDS MANY EYES

The ancient Hindus created the goddess Siva with multitudinous eyes and hands, as a symbol of completeness and omnipotence. Today, modern industry has created a production Siva . . . such as Sivyer. Here many eyes, many hands combine to produce perfection in Sivyer castings. The eyes of experience . . . the penetrating eyes of scientific instruments . . . the deft hands of molder and finisher . . . all are centered in one body with one goal and one tradition . . . the production of the finest in high alloy, low alloy and carbon steel castings for all industry.



# SIVYER

SPECIALISTS IN HIGH ALLOY AND SPECIFICATION STEEL CASTINGS

SIVYER STEEL CASTING COMPANY • MILWAUKEE CHICAGO

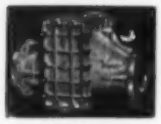
# FLAME PROTECTION

FOR ALL YOUR

*Inflammable*

GAS LINES!

"VAREC"
approved
HORIZONTAL
FLAME ARRESTERS
2" to 12" sizes



"VAREC"
approved
VERTICAL
FLAME ARRESTERS
2" to 12" sizes

In handling inflammable gases, the danger of fire and explosion is ever present. Resulting flames will travel rapidly along lines of least resistance. When your gas lines are protected with "VAREC" Approved Flame Arresters, you can be sure of stopping flame propagation to any storage or gas-making unit.

"VAREC" Flame Arresters are scientifically designed with streamlined housings and expanding passageways to permit maximum gas flow with minimum pressure drop. The free area through the flame arresting grids is 4 to 5 times the free area of corresponding sized pipe. To counteract corrosion, these flame arresters may be obtained in suitable materials for various gases.

"VAREC" Approved Flame Arresters are listed by the Underwriters' Laboratories and approved by Factory Mutual Laboratories as well as other safety authorities. Demand that these accepted devices be installed on all your inflammable gas lines.

PROVED and APPROVED "Varec"

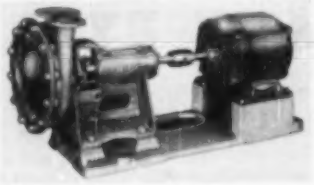
THE VAPOR RECOVERY SYSTEMS COMPANY
COMPTON, CALIFORNIA, U.S.A.

NEW YORK 30 CHURCH ST. PITTSBURGH 710 GULF BLDG. CHICAGO 122 SO. MICHIGAN AVE.
TULSA 409 TULCHIA BLDG. HOUSTON 821A M. & M. BLDG.
CABLE ADDRESS: VAREC COMPTON (ALL CODES)




is a glass extension containing an indicator connected to the float by means of a rod. The wide angle indicating scale can be read at any point within a 180-deg. arc, while the glass is protected on the front by a stiffening rib which does not block vision. Sizes range from 1 to 12 in. in diameter, for ¾ to 4-in. connections, and capacities on air (at 4-in. water column pressure drop) from 55 to 20,000 SCFH. Flow of other gases depends on the properties of the gas.

*Fischer & Porter Co., Hatboro, Pa.*



FOR CORROSIVES:

## Stainless Pumps

In the new line of stainless steel centrifugal pumps recently announced by Goulds, the entire fluid end is of

(Continued)

## FASTER ALUMINUM WELDING

At least four times faster than any previously known method of welding aluminum, a new process developed by Air Reduction Sales Co. at its Murray Hill, N. J., laboratories, and at Battelle Memorial Institute, is now available for joining aluminum plates from ¼ to 3 in. or more in thickness. Known as Aircomatic, the process uses a pistol-shaped welding tool with bare or processed filler metal in wire form supplied at controllable rates of speed. A sheath of argon or helium gas surrounds the arc, preventing air from contacting the molten metal. Since no solid fluxes are required, there is no slag to be cleaned from the joint.—Air Reduction Sales Co., 60 East 42nd St., New York, N. Y.

# NOW...

## it is easy to select the speed reducer you require

This *new* 44-page bulletin gives simple, easy-to-understand directions for selecting speed reducers of the horsepower and speed you need. It contains specifications, horsepower rating tables, overhung load capacities, dimensions and weights of single and double reduction units.

These reducers are equipped with Farrel-Sykes continuous-tooth, herringbone gears—the famous *Gear with a Backbone* — which provide extra strength and high load-carrying capacity. Because they are generated with a high degree of precision, these gears are extremely quiet in operation and give many years of trouble-free service.

Other features described in the bulletin, which contribute to smooth, efficient power transmission, include rigid and accurately ground shafts properly mounted in roller bearings, and heavy-section cases that hold rotating elements in precise alignment.

**FARREL-BIRMINGHAM CO., INC., 344 Vulcan Street, Buffalo 7, N.Y.**
*Plants:* Ansonia and Derby, Conn.; Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Detroit, Chicago, Los Angeles, Tulsa, Houston

*Farrel-Birmingham*

If you buy or specify speed reducers, you should have a copy of this handy manual. Fill out the coupon and drop it in the mail today.

FB-50

CE

Farrel-Birmingham Co., Inc., 344 Vulcan St., Buffalo 7, N.Y.

Please send me, without cost or obligation, a copy of Bulletin 449, "Farrel Speed Reducers."

Name_____

Company_____

Address_____

City_____ State_____

# One undivided responsibility!

## ...to solve your dust and fume control problems

For 42 years, Kirk & Blum has specialized in the DESIGN, FABRICATION and INSTALLATION of efficient, dependable systems for the removal of dust and fumes.

**DESIGN:** Kirk & Blum engineering specialists survey your plant and then design your system, selecting equipment most suitable for your problem.

**CONSTRUCTION:** Kirk & Blum fabricates the complete system (equipment excepted), "tailor made" for your installation.

**INSTALLATION:** The Kirk & Blum contract includes responsibility for the entire system, installed by mechanics with years of specialized experience in the installation of such systems.

*As a result, you have one undivided responsibility* — one complete contract for an installed system, ready to operate. Write for literature. The Kirk & Blum Mfg. Company, 2908 Spring Grove Ave., Cincinnati 25, O.

FOR CLEAN AIR ... THE [redacted] TOOL

**KIRK AND BLUM**

DUST & FUME CONTROL SYSTEMS




stainless steel, mounted on a substantial cast iron support. The new line includes eight sizes, from 1 to 3-in. discharge, with capacities up to 750 gpm. and heads up to 180 ft., depending on capacity. The pump is designed so that the stuffing box is under suction pressure only. Both suction and discharge connections are located in the casing, while the removal of a casing cover, without disturbing the piping, permits the interior of the pump to be inspected, or the impeller to be removed or replaced. Provision has been made for easy adjustment of the clearance between the impeller and casing to compensate for wear without disturbing the coupling. Many parts are interchangeable to permit users to minimize spare parts inventories. Pumps are produced both in Type 316 and in Type FA 20 stainless steel. Construction may employ either a stuffing box or a single or double mechanical seal.

*Goulds Pumps, Inc., Seneca Falls, N. Y.*

## Briefs . . .

**GAS ELECTRIC TRUCK.** Motorized hand trucks of the Barrett Power Ox line, hitherto powered by storage batteries, are now optionally available with a gas-electric unit which replaces the usual storage battery. Both lift and travel are electrical, but the unit can be operated 24 hours a day without down-time for battery charging. *Barrett-Cravens Co., 4601 South Western Blvd., Chicago 9, Ill.*

**FLAME PHOTOMETER.** For rapid quantitative determination of potassium and sodium, a new flame photometer offered by Barclay Division has been designed for maximum rapidity of use, coupled with high accuracy and reproducibility. The instrument uses a straightforward d.c. circuit with a sensitive but rugged galvanometer as an external null indicator. *Barclay Instruments Div., The Patent Button Co., Waterbury, Conn.*

**CURVE PLOTTER.** Recording instruments ordinarily plot one variable against time. A new version of the L & N Speedomax automatically plots the relationship between two variables, neither being time. The new recorder has two measuring circuits, one controlling the pen and the other the chart paper drive. Both, of course, are reversible. Typical uses include plotting of temperature vs. temperature differ-

(Continued)

**DRY SEAL CLOSURE**

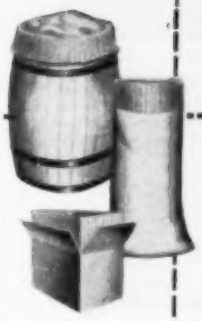
- PRE-FORMED FOR QUICK ACCURATE SEALING
- EASILY CLOSED WITH HAND ROLLERS
- NO SEWING MACHINE IS NECESSARY
- MASKING TAPE EXTENDING BEYOND EDGES, PERMITS QUICK REMOVAL FROM SEALING SURFACES

# CHASE *PROTEX*

## WATERPROOF • PAPER-LINED BAGS

## MADE WITH CEMENTED CENTER SEAMS!

TOPMILL Burlap or tested Cotton fabric . . . laminated to crinkled kraft with various waterproof adhesives. Cemented center seams and taped bottoms eliminate porous sewing holes, assure additional moistureproof protection. Sharply printed for quick brand identification. One of the many Chase bags of special construction designed to meet unique packaging problems.



### CHASE LINERS

They're crinkled and pleated for two-way stretch . . . withstand stress and strain. Safeguard product from outside contamination. Available for added protection of products packed in barrels, boxes, and bags.

Chase Bag Co.
309 W. Jackson Blvd.
Chicago 6, Illinois
Gentlemen:
Please send me more information about
☐ Chase Waterproof Bags
☐ Chase Crinkled Liners
For packaging.....
☐ Please have salesman call

Firm.....

Address.....

Att.....

**CHASE BAG CO.** GENERAL SALES OFFICES: 309 W. JACKSON BLVD., CHICAGO 6, ILL.

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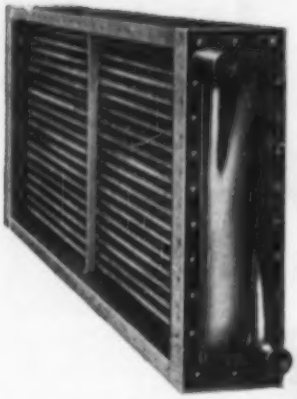
OKLAHOMA CITY • PORTLAND, ORE. • REIDSVILLE, N. C. • HARLINGEN, TEXAS • CHAGRIN FALLS, O. • HUTCHINSON, KAN. • CROSSETT, ARK. • SAN FRANCISCO

Figure it at

100% FULL RATING



AEROFIN RATINGS ARE ACCURATE AND RELIABLE

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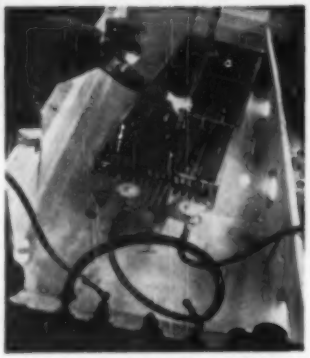
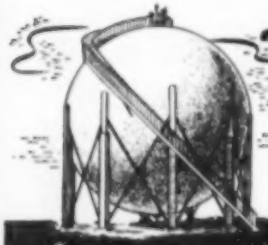


This man is looking for air bubbles – he is testing Aerofin heat-transfer coils with air pressure in a specially illuminated tank. If there are no bubbles, it means the immersed Aerofin unit has withstood the severe strains of steam and hydrostatic pressure tests and is ready to give you long, efficient service.



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ence and stress vs. strain. *Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa.*

**UNIVERSAL MONOCHROMATOR.** Perkins-Elmer is now offering its Model 83 Monochromator, a universal type covering the ultraviolet, visible and infrared regions of the spectrum. It is said to be the first universal instrument of this type. A variety of prisms and accessories is available to give this wide range. *The Perkin-Elmer Corp., Glenbrook, Conn.*

**SUBMERGED COMBUSTION UNIT.** The Ozark principle of submerged combustion is now available in a small packaged unit for experimental work, in a size burning any gaseous fuel, at rates up to 24,000 Btu. per hr. It is capable of evaporating 10 to 20 lb. of water per hr. The unit is of stainless steel, ready to operate by plugging into a standard power line and attaching the fuel supply. *Ozark-Mahoning Co., P. O. Box 449, Tulsa, Okla.*

**SURFACE PYROMETER.** An all-purpose pyrometer for surface and sub-surface temperature measurements of almost every type is now being offered in two series of models, one with a rigid extension arm, the other with a 42-in. flexible arm suitable for use with any of eight types of thermocouples. Each series is available in four ranges from 0 to 400 deg., to 0 to 1,200 deg. F. Both have 4-in. indicating dials and are self-contained and portable. *Pyrometer Instrument Co., Bergenfield, N. J.*

**SPECTRORADIOMETER.** As a companion to its recording spectrophotometer, GE has now developed a recording spectroradiometer to aid in study of fluorescent materials, phosphors and light sources. Similar in principle to the spectrophotometer, but used to measure light rather than color reflected from an object, the device is sensitive to both visible and ultraviolet radiations. *General Electric Co., Schenectady 5, N. Y.*

**METAL DETECTOR.** Eriez is now offering a metal detector of the electronic type which will detect metals of any kind in non-metallic materials. Material flows on a belt through a search coil. If metal is present the detector automatically stops the belt or operates signals. Adjustment is possible for the minimum size of metal particle which will cause action. *Eriez Mfg. Co., Erie, Pa.* —*End*

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# Stop Defending Bigness in Business

**It is the job of every man and woman in the process industries to preach the facts: In peacetime, bigness has a vital place in the American system. In war it**

BRADLEY DEWEY

It was the great companies of America's industry that provided the arms and equipment with which our soldiers, our sailors, and our airmen won World War II. And it is to these same big companies that the United States must turn if she is called upon to defend herself again.

Our big process companies teamed with the government to furnish the technical brains, the know-how and the sheer power to produce in tremendous volume such industrial miracles as synthetic rubber, high octane aviation gasoline, toluene, magnesium, rocket powders, and the atomic bomb.

Teamwork won the war—and it was primarily big business that furnished the teams. Chemists and physicists—chemical, mechanical and electrical engineers — production men and skilled workers—all trained by industry and its engineering consultants, made up the elaborate structure of the process industry teams that fought the war behind the lines.

If—and God forbid—we must again defend ourselves, then again we will have to call upon great and strong units of industry to provide us with what we need. Yet today we have the strange sight, the frightening sight, of the defense branches of government spending billions of dollars for our defense, while other arms of the same government seek to pull down and destroy our greatest defense asset—the bigness of the companies upon which we must rely in war.

I am not going to *defend* bigness in industry. I am tired of hearing it *defended* as though bigness in itself were wicked or immoral or criminal. Far from defending bigness in business, I assert its necessity; its necessity in peace and particularly, its necessity in war.

General Vandenberg, Air Force Chief of Staff, is only one of numerous military men to declare that we cannot hope to match Russia in masses of men, and that we must, therefore, rely upon technical superiority which must come from technically superior industry.

We in the process industries know that technical prowess is, as a rule, directly related to size. No process company can grow except by constant effort toward technical superiority; and bigness is the inevitable long-term result of technical improvement and superiority.

Trying to measure bigness in modern day industry is like trying to say how long is a piece of string. The biggest of corporations has competitors and in order to stay strong and healthy must give its rivals constant battle, striving daily to improve its own products and its own methods. Large, medium and small companies are a necessary part of the American economy. All prosper together.

Should war come tomorrow—and again I say, may God forbid it ever come—there would be available to the government not only the physical products of our industry's bigness, but there would also be available big industry's teams of scientists, engineers and skilled workers.

America amazed herself, and the world as well, by mass producing synthetic rubber in World War II. But, as Rubber Director in World War II, I can testify that synthetic rubber in the quantities and of the quality required for the successful conduct of that war, could not have been produced if the rubber companies and the mighty process industries and their construction and engineering affiliates had not provided the teams of chemists, physicists, engineers, production specialists, administrators and trained workers.

However it may have appeared to some outsider, it was not the government that developed the processes, built the plants or turned out the rubber. Government merely supervised, steered, advised. Men of the rubber, chemical and petroleum industries and their construction associates and engineering consultants—they are the men who did the job. It was the technical prowess of these companies, so competitive in time of peace but pooled in time of war, which gave to the nation the technical superiority it had to have to produce rubber after our enemies cut us off from our supplies of the natural product.

This, I submit, is the fruit of bigness— the bigness General Vandenberg and the other military leaders have in mind when they say our success in war will rest on technical superiority. Dr. Vannevar Bush points this up very succinctly in two sentences of his great new book, "Modern Arms and Free Men," when he says, "Modern science has utterly changed the nature of war and is still changing it . . . The combination of science, engineering, industry, and organization during the last decade created a

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BRADLEY DEWEY *is not a "big business" man in the sense that Du Pont and A&P are big business. By such standards Dewey and Almy Chemical Co.'s 16-million-dollar business is respectable, but no giant. Yet seldom has the case for bigness been presented so powerfully as Colonel Dewey stated it last month in his challenge to the 1,000 chemical engineers gathered to honor Celanese Corporation of America as it received the 1949 Award for Chemical Engineering Achievement—achievement incidentally in group effort and teamwork, which are themselves fruits of bigness.*

# . . . Preach It

**is our salvation . . . . . WHO BUT A DU PONT** could have tackled and completed the job at Hanford?

**WHO BUT A MONSANTO** could have replaced the Texas City styrene plant and its 34 top men in less than a year?

**WHO BUT A CARBIDE & CARBON** could mobilize the coordinated experience and ability of more than 3,000 technically trained people?

**WHO BUT BIG BUSINESS** could meet another gigantic war demand for synthetic rubber, gasoline, aluminum, magnesium, steel, etc., etc.?

new framework that rendered conventional military practice obsolete."

How quickly we can lose technical superiority if we permit misguided zealots to whittle down industry or to stunt wholesome, healthy growth to bigness! It is up to all to encourage bigness as long as it obeys the laws that govern us all. How can we hope to maintain modern science, upon which technical superiority is based, unless we give engineers and technologists elbow room in time of peace to team with our scientists and continue to build to the unlimited horizons of our democratic country?

If there was any one lesson more outstanding than another learned in the last war it was the absolute dependence of the armed forces upon the teams of industry and business for the development of new arms and weapons.

Among these teams were the ones who in prewar peacetimes had been able to work on problems which then had little hope of being used for a decade ahead. Among them were ones who sent teams of investigators to Germany to bring back the techniques which let us more quickly make butadiene and styrene for synthetic rubber. Among them are those who can afford to work on ideas and to pay for dreaming for the future.

The cry which we now hear that bigness in business is bad is a false cry and a dangerous one. It is as false to say that all big things are bad as it is to say that all little things are good. We have laws against big and little sinners and we should employ them against the big as well as the little in business. But in bigness *itself* there is no sin.

Now let me talk for a minute about a giant of industry. This one is so great that the government turned to it to handle its top secret wartime atomic project construction and operation at Hanford, Wash. I refer, of course, to the Du Pont company. Today the same government which disbursed more than one billion dollars through Du Pont during the war is attacking Du Pont on the ground that it is too big. Yet it was the bigness of Du Pont which led the government to its door in time of national peril. The fact is that Du Pont paid out to other companies 56 percent of all the money the government paid to it and that although Du Pont had the lion's share of the vast responsibility imposed by the government, it shared profits with thousands of subcontractors, big and little. And after all operating costs were paid, wages and salaries eating up 44 percent, the Du Pont company had left as its own profit to stockholders, after taxes, about 1/15 of a cent of dollar cost.

I did not single out the Du Pont company for special mention. The government did that. The government which leaned so hard upon the Du Pont company for help in the war now singles it out as being wicked because it is big. And if this attack were successful, misguided and misinformed zealots might single out other companies and blast them for the crime of bigness. But let us look at other companies.

What company except a big company like Monsanto could have replaced the Texas City styrene plant and its 34 top administrative, supervisory and technical men in less than a year after an explosion had wreaked its havoc? Could any company less than the size of Monsanto have carried on five separate vital large wartime projects.

Consider Union Carbide and Carbon's power when it brought to the war effort the experience and abilities of more than 3,000 technically trained people—1,400 of whom were engineers and technicians working in 23 research laboratories spread through 185 plants. Carbide and Carbon made the butadiene from alcohol that was so vitally needed at the start of the rubber program. When we had to build the enormous butadiene plants (and reactions had to be piloted even while the plants were still under construction), where could we have turned except to the big oil companies like Standard of New Jersey, Humble, Standard of California, Gulf, Texas, Shell, Sun, Socony-Vacuum, Cities Service, Phillips, Pure Oil, Sinclair, Standard of Indiana, Imperial Oil, and Atlantic.

Only a great chemical company could do what Dow did when it not only suprevised the construction but staffed the enormous styrene plants at Velasco, Los Angeles and Sarnia. And remember it did this while designing and building the facilities for a giant magnesium program. Only a great company could have contributed the hundreds of top flight executives, supervisors, engineers and designers for such a prodigious undertaking.

Who but the great rubber companies could have taken on not only the polymerization of synthetic rubber, but at the same time largely redesigned tires and the machinery, processes and factories necessary to fabricate new materials into tires to win the war?

Earlier I spoke of misguided and misinformed zealots because I believe that many of those who attack business because of its size have no idea what constitutes size or how modern business really operates. I think they honestly do not know that Big and Little Business could not exist in our

great democratic economy without each other any more than Labor and Capital, or Farmer and Merchant, could exist only for themselves and by themselves.

As a rather small businessman, I am well aware that my company could not exist if it did not have big as well as small customers to which to sell its products. As one who buys from, sells to and competes with businesses as big as his own and also much bigger, I think I am in a position to understand how big and little businesses are dependent upon each other and how necessary both are to the American way of life.

But there is one more thing I have to say. How can misguided critics learn the truths about our process industries unless we who are in the industry tell these facts? How can the American public, upon whose passions and emotions misguided zealots are now playing with their incessant criticism of size in business, learn the facts unless we who know the facts talk about them?

It is the job of every man and woman connected with the process industries to marshal the facts and to preach the facts. Let us cease mere passive defense of bigness and let us start preaching aggressively the necessity of bigness for the salvation of the nation in time of war.

We all knew that only big companies can mass produce such products as automobiles and that only mass production can bring the automobile price within the range of most American incomes. But too many of our fellow citizens do not know that national defense in the the future will depend almost entirely upon the quick mobilization of industrial teams and their integration into war teams. Bigness is a vital national asset in war and we can no more risk limiting this bigness than we can risk giving the secrets of atom bomb construction or the blueprints of our newest guided missile to potential enemies.

We honor the Celanese Corporation of America tonight because it successfully risked millions of venture capital on research. Only a big company could do this. Let us now do what we can to put an end to loose and reckless talk of the badness of bigness. Let us make clear to all that in peace and in war bigness has a vital place in the American system. It insures our future. If we make our story heard by the American people, I for one have no fear of the outcome. The American people are not deaf to an appeal to reason as powerful as this appeal we make for our preservation as a nation. —*End*

# National Defense and the

**The university has a two-fold mission: strengthen our moral fiber, strengthen our economic prosperity.**

In these parlous times of cold war and hot issues, what are the special responsibilities of our universities in serving our national security?

When considering the relationship of education to national welfare we must first separate out certain basic elements of our national strength. Most basic of all is the fiber of our people—their spirit, their moral integrity, their maturity, and their capacity to govern themselves. We must have the kind of education which engenders and strengthens these qualities. Our colleges must give our students, who are tomorrow's leaders, an understanding of our American heritage and of the sacredness of individual liberty in a free society. They must help to create this common bond of our democracy. As President Sproul of the University of California recently said, ". . . how necessary it is that the universities of America should constitute an affirmative force—the chief advocates of our traditions, our institutions, our way of life—that they should not only inquire fearlessly into the defects of our system, but also highlight and extol its advantages and aggressively clarify and strengthen the ideas upon which it rests." I submit that this function of our universities is vital to our national welfare.

Our universities must also do more than they are now doing to aid our young people to grow in moral and spiritual stature. Our people not only must be literate; they must harness literacy to ideals and to a sense of the first rate. Whitehead once said that, "Moral education is impossible without the habitual vision of greatness." Better than any other agencies, our colleges can provide this vision of greatness. In a democracy it is vital that they do so.

Universities, if they are to serve our free society, must not only train men who can do the complex specialized work of society; they must also cultivate in these men a reverence for the dignity of the individual. Someone has said that democracy is most effective when it tries to make all of its citizens aristocrats. It might also be said that education for the protection of democracy is most effective when it strengthens the aristocratic virtues of personal dignity, self-reliance, and self-understanding. Men with these qualifications are more likely to resist all forms of statism and Stalinist communism that regiment and depreciate the individual and therefore weaken democracy.

Next to the fiber of the people as a component of national strength stands the health and wealth of our people. A healthy people, a prosperous economy, and ample natural resources are three of our main defensive lines, and all three of these now depend upon the endless frontier of basic science. Our universities must educate the men and conduct the research to keep this frontier endless.

In our dynamic economy we must constantly create more jobs for more people. We must steadily increase our output per manhour, if we are to have better and cheaper consumer goods along with higher wages. To do these things requires a steady increase in our fundamental knowledge of nature. Research must also provide us with replacements and substitutes for depleted natural resources. In fact one of the major tasks of science in the universities and in industry in the years ahead will be the conservation of natural resources and the replacement of scarce materials by equally good or better substitutes. As the wellsprings of basic science, our universities are vital factors in meeting all of these requirements for a prosperous economy. They are also essential for educating men for the refinement and management of our industrial machine. The record seems to be clear that engineers have demonstrated an extraordinary capacity to manage great enterprises. I believe that in part this reflects the kind of training they have had, and that it points up the opportunities in our universities to train men still more effectively for management responsibilities. If we are to do this, we must educate men of professional competence who have a cultural reach beyond the techniques of their profession, men who have an understanding of social forces and a capacity for leadership.

Let me mention one reason why a broader education is of practical importance to industry. Industry more

# University . . . A Mission in Peril

JAMES R. KILLIAN, JR.

and more is looking to technological schools for potential leaders, for the men who must be the managers, the industrial leaders of tomorrow. Graduates of engineering schools often enter industry through a specialized technical channel, with the result that only those few individuals with superior natural endowments rise to top-level posts in management. Industry, because of sound organizational requirements, must insist on specialization among its young scientists and engineers, and is therefore handicapped in increasing the quantity of potential leaders at a time when they are at an impressionable age. When technical education is too narrow, it tends to restrict the supply and development of leaders. By further broadening their teaching programs, our engineering schools have an opportunity to contribute to the solution of this problem, so essential to the management of our highly technical private enterprise system.

**But it faces a triple threat: development at the expense of research, security by secrecy, impoverishment.**

As our educational institutions strive to nurture these elements of our national strength, they encounter today certain hazards which are inherent in the cold war.

Today, for example, we are under constant temptation to divert scientists and engineers in our colleges away from fundamental research by bending their interest too much toward development. If allowed to happen on a large scale, this could dry up the wellspring of new knowledge with ultimate disaster to our national security. Not even the knowledge that an atomic explosion has occurred in Russia can justify our weakening basic research by the diversion of undue numbers of our first-team scientists to development work or to crash programs. I believe that the national defense establishment can continue to work on the development of new weapons essential to our defense without aborting our basic research and educational programs by shifting the emphasis from long-term research to short-term objectives. If ever we are forced or deluded into such a program in peacetime, then we have cut the taproot of our future security and our industrial advance.

A second hazard to our universities resides in the imposition of restrictions on the free exchange and communication of information. Only under very special and urgent circumstances should secret work be brought into our universities. It is incompatible with the basic concept of an educational institution as a source and distributor of knowledge.

Both within and without our universities I believe that scientific advances are being retarded today by too much secrecy. In the public mind secrecy is mistakenly considered synonymous with security; actually secrecy and scientific progress are mutually inimical. I am not one of those who believe we should have no secrets—that is obviously absurd in a period of cold war. I do believe that we can achieve a better balance between secrecy and free exchange of information for the purpose of accelerating our scientific advance. If there were fewer secrets in our atomic energy program, for example, we could forge ahead more rapidly in atomic physics. There would be more cross-fertilization, more mutual stimulation of active minds.

"It would be better," as Dr. Karl T. Compton recently pointed out, "to take the calculated risk of allowing some confidential information to get out of our hands, if such a policy would enable us to advance our own science and art at a more rapid rate which a competitor cannot hope to equal, than it would be to impose by regulation or public opinion a condition which seriously handicaps progress by rendering employment in these pursuits definitely unattractive to top-flight scientists and engineers. . ."

A third hazard to universities as components of our national defense is their impoverishment. Professor Seymour Harris recently pointed out that in 1932 our colleges and universities spent 1 percent of our national income. By 1949 this had fallen to less than one half of 1 percent. Over this same period the enrollment of our universities had doubled. The situation is even worse if we examine the private institutions which are the pacesetters of our educational system. Their share of the national income has suffered a greater reduction than the system as a whole. Implicit in this declining support of our privately endowed institutions is the danger of their losing their private status by being forced to accept government subsidy and control. I suggest that this would be a major calamity. If the private universities come under federal control, then one of the bulwarks of free enterprise will have been destroyed. The solution, I believe, lies in diversified support for these institutions, with industry, foundations, and government joining together, and all recognizing the vital importance of these institutions remaining free of any kind of control. I submit, however, that we must adequately finance all of our universities, whatever the source of funds, if our system of higher education is to continue adequately to serve our democracy. Our universities, if they are strong and powerful, are a striking force that can be thrown into immediate action if needed, as was demonstrated in the last war. We must be sure to have in these institutions this kind of reserve strength, and we must strive unremittingly to prevent it ever having to be used for war.

Such are some of the responsibilities, obligations, and problems of education in this critical period. I believe that the symbiotic relationships between industry and education must be further strengthened if our educational institutions are to remain strong. I believe that industry has a responsibility to see that they do. I believe that our free institutions can continue as potent pillars of our national strength, if they are not diverted from their primary responsibilities, and if we can circumvent the hazards of these parlous times.

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JAMES R. KILLIAN, JR., *might well be called Mr. M.I.T. For 25 years Massachusetts Institute of Technology has been his life—as student, editor, assistant to President Compton, vice president, and since 1948, president. With his townsman, Colonel Bradley Dewey (preceding article), President Killian spoke before the group gathered for the presentation ceremonies in which Celanese Corp. of America received the 1949 Award for Chemical Engineering Achievement.*

# New Products and Materials

*JOSEPH A. O'CONNOR, News Editor*

BUILDING BLOCKS:

## Trio of Silanes

Thermal stability and rapid curing time are the outstanding features of three new industrial organosilicon compounds just introduced by Linde Air Products Co. The three silanes, vinyltrichlorosilane, diethyldichlorosilane and phenyltrichlorosilane, are building blocks that can be reacted easily with other organosilicons, alkyd resins, intermediates, and some unsaturated organics, to produce liquid or solid polymers.

Linde chemists are confident that these new silanes will accelerate production of silicone materials now used in the paint, electrical and protective coating fields. Likewise, they are expected to step up research into other new products and processes.

Organosilicon chemicals are currently used to produce such widely varied industrial products as hydraulic fluids, mold-release resins, electrical insulation, paint vehicles and rubber-like materials.

The three new Linde silanes, soluble in most organic solvents, are colorless, fuming liquids, with molecular weights ranging from 157.10 to 211.54, and boiling points from 88 deg. C to 201 deg. C. The variety of useful polymers possible with these silanes is due largely to highly reactive Si-Cl groups that can be converted readily to Si-O, Si-N, Si-S, and other groups. All chlorine atoms in these chlorosilanes can be replaced. Hydrolysis and condensation reactions using suitable catalysts yield liquid or solid polymers whose composition and properties can be controlled at will.

Of special interest to potential users is the fact that the vinyl group in Linde vinyltrichlorosilane is available for reaction before or after polymerization, a property that opens up new fields of reactions and products. Vinyltrichlorosilane can also be reacted with unsaturated organics, or blended with other organosilicons and intermediates.

These new Linde silanes are available now from pilot-plant production in the following quantities: vinyltrichlorosilane in 1-, 5- and 10-lb. containers; diethyldichlorosilane in 1-, 4- and 8-lb. containers, phenyltrichlorosilane in 1-, 5- and 11-lb. containers. Larger quantities can be obtained, but advance notice is required.

Further information and prices can be secured from the manufacturer.

*Linde Air Products Co., 30 East 42nd St., New York 17, N. Y.*

HAS LOW VISCOSITY:

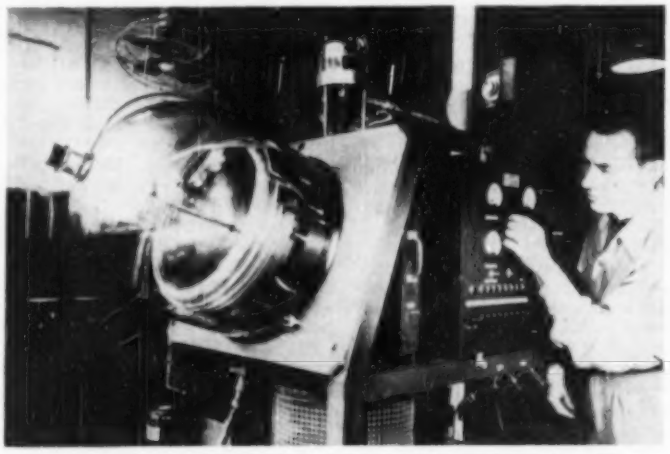
## Polyester Plasticizer

A polyester plasticizer that combines the best properties of both the monomeric and polymeric types has been put into full plant-scale production by the Resinous Products Division of Rohm & Haas Co. Designated Paraplex G-60, the new product is characterized by low viscosity, high plasticizing efficiency, good behavior at low temperatures, light color, broad compatibility and low cost.

As a plasticizer in polyvinyl chloride compounds, the new G-60 is said to bring low-temperature flexibility to polyvinyl sheet and film stocks. In part because of its low viscosity, it has demonstrated its usefulness in the preparation of vinyl dispersion compounds such as organosols and plastisols. Also, it has been found to exert a unique and useful stabilizing action on PVC type resins, producing compounds that appear to offer significant advantages by eliminating such objectionable characteristics as staining, opacifying, and spewing, often associated with the use of conventional stabilizers.

Properties of the new Paraplex—notably its high plasticizing efficiency, light color and clarity, low viscosity, and outstanding compatibility with solution-grade vinyls—are said to permit economical formulation of vinyl lacquers of high quality.

Still another major use is as a combination plasticizer-stabilizer of chlorinated compounds. For instance, low concentrations of Paraplex G-60 have been found to improve the film length, adhesion and heat stability, and to increase the film toughness of coating



BETTER LUBRICANTS PROMISED BY MOLECULAR DISTILLATION

**To provide information leading to improved lubricants and to make possible the design of better and more economical refinery equipment, the technique of molecular distillation is being put to work in the Beacon Research Laboratories of the Texas Co. The shallow steel cone, 14 in. in diameter, is spun by a motor at 1,725 rpm. Centrifugal force spreads the oil, which is fed to the center of the cone through a tube, over the surface. The cone is radiantly heated, and the more volatile portions of the oil are distilled off, while the less volatile are thrown off the edge as residue. The liquid being distilled is spread out in a layer only 3,000 molecules thick. It is exposed to the heat of distillation for less than 1/10 of a second, thus minimizing decomposition of the hydrocarbons. Entire process takes place at an absolute pressure of about 1 micron.**

compounds such as chlorinated rubber. The new G-60 complements rather than replaces G-25, G-40 and G-50, earlier members of the Paraplex family.

*Rohm & Haas Co., Resinous Products Division, Washington Square, Philadelphia 5, Pa.*

STABILIZED:

### Blue Azoic Dyestuff

A new stabilized azoic dye, Calconyl Blue G Powder, and, in its solution form, Calconyl Blue G Single Solution, is now being turned out by the Calco Chemical Division of American Cyanamid Co.

Both the powder and the solution forms of the dye are recommended for cotton printing, where acid aging is available, to produce economical, clear, full navy blue shades. The dye affords good fastness to light and outstanding fastness to washing, perspiration, dry cleaning and plissé.

These Calconyl Blues are said to be satisfactory for use in patterns together with other acid-aging types of dyes, such as soluble vat dyes, or with resin-bonded pigments. Suggested uses are for printing dress goods, tablecloths and handkerchiefs. Both forms of the dye are reported to be stable under normal storage conditions. Calconyl Blue G Single Solution is said not to precipitate or separate on long standing in the color shop.

*American Cyanamid Co., Calco Chemical Division, Bound Brook, N. J.*

HYDROGENATED:

### Cashew Nut Shell Liquid

Irvington Varnish & Insulator Co. can now supply its new Hydrogenated Cashew Nut Shell Liquid in unlimited quantities. Actually a low-melting, waxy solid, it consists of a mixture of various meta-substituted phenols.

It contains approximately 50 percent 3-pentadecyl phenol, 5 percent 5-pentadecyl resorcinol, and 35 percent phenols of higher molecular weight.

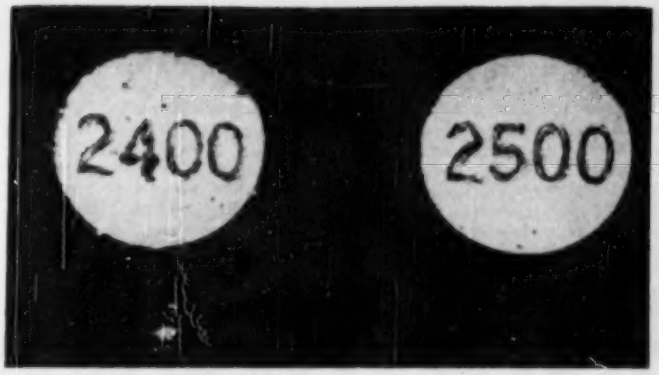
Technical data and samples can be obtained from the manufacturer.

*Irvington Varnish & Insulator Co., Irvington 11, N. J.*

STABILIZED:

### Fatty Acid

Developed by W. C. Hardesty Co., Inc., specifically for use in grease manufacture, Lubrex 45 is a new polyunsaturate-free fatty acid.




**TEMPERATURE-INDICATING PELLETS**

**Surface shown above has been heated to a temperature between 2,400 and 2,500 deg. F. This is indicated by the fact that the 2,400 deg. F. Tebpil® Pellet has begun to melt, while the 2,500 deg. F. Tempil® Pellet remains intact. Pellets for the temperature range from 2,000 to 2,500 deg. F. have just been added to this line. Beginning with 113 deg. F., Tempil® Pellets are now available in 12½-deg. steps to 400 deg. F., in 50-deg. steps from 400 to 2,000 deg. F. and in 100-deg. steps from 2,000 to 2,500 deg. F. They afford a simple method of indicating these higher temperatures, all important in today's technology. Tempil® Corp., 132 West 22nd St., New York 11, N. Y.**

The fatty acids in Lubrex 45 are stabilized in a new hydrogenation unit recently installed in the Hardesty plant at Los Angeles. This stabilization gives Lubrex 45 greater resistance to heat discoloration. Moreover, freedom from polyunsaturated fatty acids prevents rancidity or gum formation that normally results from excess saturation.

Melting point of Lubrex 45 is precisely controlled at 45 deg. C., and color and uniformity of Lubrex 45 are also subjected to laboratory control as each batch is produced.

*W. C. Hardesty Co., Inc., 41 East 42nd St., New York 17, N. Y.*

SURFACE-ACTIVE:

### Rosin Amine Salt

One of the most versatile products recently stemming from Hercules Powder Co.'s research in rosin chemistry, Rosin Amine D Acetate (called RADA), is being successfully used by the petroleum industry. A surface-active organic amine salt in water-soluble form, Rosin Amine D Acetate has also found applications in many other fields.

Rosin Amine D Acetate is being used in oil fields where the extraction of crude petroleum depends largely on secondary recovery methods, one of which is water injection.

This new chemical provides control of bacterial action and affords protec-

(*Continued*)

## This Month . . .

Here are a few samples of the novel products and materials you will find described on following pages. . . Bothered by rust in pipelines and storage tanks holding light oil products? The **rust inhibitor**, p. 162, may be the answer to your problem. . . On p. 162 also, you'll find out about a cement that comes in handy for jointing acidproof brick and pipe. It's made of a **thermosetting resin**. . . If you're looking for **high-purity fatty acids**, be sure to turn to p. 164. There you'll learn about a series of fatty acids, purified by a new process, that go as high as 97 percent in stearic acid content. . . . Also described on p. 164 is a **liquid cement** for bonding cellulose acetate objects. It works better than acetone and is far less hazardous. . . See p. 166 to discover how **citric acid** is being used to prevent precipitation of 2,4-D salts by hard water.

## Next Month . . .

Among the new products we'll be reporting on next month are an **alkyd putty material**, a soft-flow **acrylic molding power** and a new **aluminum stearate** of greater gelling efficiency. . . Also, there's a **fungicide-containing enamel** that controls mold and mildew.

tion against corrosion of water-flooding systems. The reduction in corrosion and bacterial action aids in maintaining suitable water pressures required in the secondary recovery operation.

RADA also acts to reduce turbidity in flood water, thereby preventing plugging of oil-bearing sands. It is adaptable to a wide range of flood waters. Another advantage is that no expensive equipment or complicated methods of application are required.

*Hercules Powder Co., 952 Market St., Wilmington 99, Del.*

FOR OIL PRODUCTS:

## Rust Inhibitor

A new rust inhibitor for light oil products in pipelines and in static storage is being marketed by Monsanto Chemical Co. A hydrocarbon-soluble, water-insoluble, non-metallic organic material, it will be sold under the trade name Santolene C. It is intended to be used in such products as gasoline, fuel oil and kerosene.

This new product is effective at a dosage of 0.002 percent by weight, or 0.75 gal. per 1,000 bbl., when tested according to modified ASTM D-665-47T against distilled water. Concentrations up to 0.01 percent may be necessary against sea water. Initial results of pipeline tests under way with Santolene C look promising.

Santolene C concentrations up to 0.01 percent seem to have no effect on the usual specification items for gasoline, kerosene and No. 2 fuel oil. An exception is the ASTM glass dish gum on gasoline at the higher concentrations, when a moderate increase may be noted. This increase is not more than 1 mg. per 100 cc. per 0.002 percent Santolene C.

Treating cost with Santolene C at 0.002 percent, with a displaced fuel credit of 10 c. per gal., is said to be about 0.14 c. per 42-gal. bbl.

*Monsanto Chemical Co., St. Louis 4, Mo.*

LOW IN COST:

## Emulsifier Intermediate

Sharples Chemicals Inc. is now producing a new technical diethylaminoethanol. It is a low cost product developed especially for emulsion work.

The tertiary amine forms an azeotrope with water, improving water-spot resistance of wax films. It may be employed as a replacement for higher priced emulsifier intermediates with no quality reduction. It may be used with lower cost emulsifiers to improve quality.

The technical-grade diethylaminoethanol is suggested as an intermediate in making oil-in-water emulsions, for example, self-polishing floor waxes, automobile, furniture and glass type polishes, and emulsion paints. Samples can be obtained.

*Sharples Chemicals Inc., 123 South Broad St., Philadelphia 9, Pa.*

THERMOSETTING:

## Synthetic Resin Cement

Electro Chemical Supply & Engineering Co. announces a new thermosetting synthetic resin cement, Lecite, having novel physical and chemical properties.

Lecite is inert to solvents, fats, oils, greases, alkalis and acids (except strong chromic, nitric and sulphuric over 60 deg. Be.) at temperatures to 375 deg. F.

It is particularly useful for jointing acidproof brick and pipe in the construction of neutralizers, disposal units, tanks, process equipment, towers, fume ducts and stacks, where exposure to the corrosive materials just mentioned is encountered.

Lecite may be stored indefinitely at atmospheric temperatures, is nontoxic, will not foam to form a porous mortar and give off toxic fumes, and sets quickly to form a dense, shiny, shock-resistant joint. It is non-flammable, and has a compression strength in excess of 10,000 psi.

*Electro Chemical Supply & Engineering Co., 750 Broad St., Emmaus, Pa.*

OF GREATER PURITY:

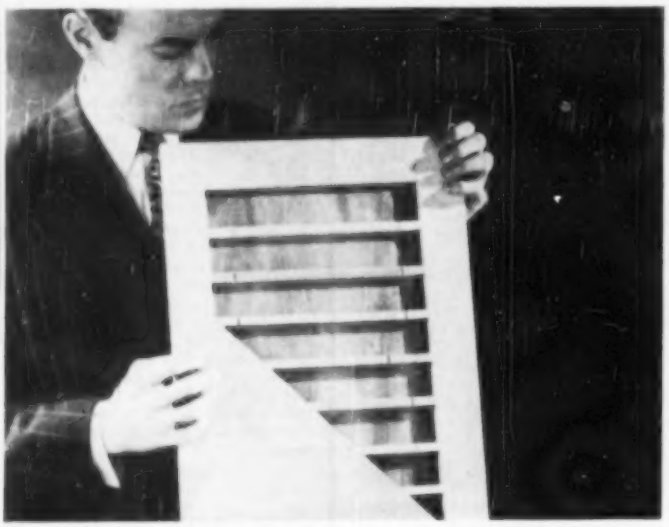
## Glyceryl Monoesters

Glyceryl monoesters of fatty acids, widely used as improvers of baked goods and as cosmetic emulsifiers, can now be prepared in much purer and more potent form, according to Distillation Products, Inc.

Purified distilled monoglycerides are now commercially available with a minimum monoester content of 90 percent. This is significant, since heretofore similar mixtures on the market have contained from 30 to 50 percent monoester.

Addition of only 1½ percent of one of the new distilled monoglycerides to the shortening of an experimental

(*Continued*)



**UREA GLUE INSURES WARP RESISTANCE**

**This warp-resistant cupboard door, made by Wisconsin Laminating Co., Chilton, Wis., has plywood facings of three-ply hardwood bonded to a rim of low density wood that is relatively inert and less subject to warp and twist. Problems of bonding high and low density woods together are solved by use of Bakelite BCU-22 urea liquid resin glue. Ribs between the facings prevent them from sinking away from a level plane, and interior ventilation keeps the inside dry and all parts at the same temperature. Manufacturer says the door will not warp and is warranted to stay flat under any normal conditions. Bakelite Corp., 30 East 42nd St., New York 17, N. Y.**

***USEFUL** as powerful reducing agents*

***USEFUL** in the manufacture of rust & polymerization inhibitors • dyes & intermediates • pharmaceuticals • photographic chemicals • rubber chemicals*

# hydroxylamine salts

**HYDROXYLAMMONIUM CHLORIDE**
**HYDROXYLAMMONIUM SULFATE**
**HYDROXYLAMMONIUM ACID SULFATE**

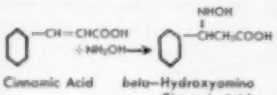
**TYPICAL REACTIONS**

**OXIME FORMATION**

$(CH_3)_2CO + NH_2OH \longrightarrow (CH_3)_2C{=}NOH + H_2O$

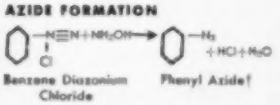
Acetone — Acetoxime

**ADDITION AT DOUBLE BOND**



Cinnamic Acid — *beta*—Hydroxyamino Cinnamic Acid

**AZIDE FORMATION**



Benzene Diazonium Chloride — Phenyl Azide†

†Due to the known instability of azide compounds, adequate safety precautions should be observed in attempting this synthesis.

The acid sulfate is the most economical source of hydroxylamine but where a purer product is necessary, the sulfate or chloride is recommended. The chloride is usually chosen for reagent purposes, such as in the determination or removal of aldehydes and ketones because it is the most soluble of the three salts in organic liquids. Therefore, it is also preferred when carrying out syntheses in non-aqueous media.

**PROPERTIES**

| | Hydroxylammonium Chloride | Hydroxylammonium Sulfate | Hydroxylammonium Acid Sulfate |
|---|---|---|---|
| | $NH_2OH \cdot HCl$ | $(NH_2OH)_2 \cdot H_2SO_4$ | $NH_2OH \cdot H_2SO_4$ |
| Molecular Weight | 69.50 | 164.14 | 131.11 |
| Melting Point °C | 152d. | 162d. | Indefinite |
| pH of 0.1M Aqueous Solution at 25 °C | 3.4 | 3.5 | 1.6 |
| *Solubility—g/100g at 25°C | | | |
| In Water | 94.7 | 63.9 | 390 Approx. |
| In Methanol | 17.5 | 0.1 | 20.2 |
| In Ethanol, 95% | 10.5 | 0.2 | 4.3 |
| In Ethanol, Absolute | 6.6 | 0.1 | 6.3 |
| In Butanol | 0.6 | 0.03 | 2.2 |

*These Hydroxylammonium salts are only very slightly soluble in ethers, esters, and aliphatic or aromatic hydrocarbons

CSC

***Write, wire, or phone CSC for a sample and further information***

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Round-bottom, 304 stainless steel. No joints, corners or rough spots to trap materials. ½ pt., 1 pt., 1, 2, 4 qt. sizes. Write for economical prices.

METALSMITHS

Division of
Orange Roller Bearing Co., Inc.
844 White Street
Orange, N. J.

NEW PRODUCTS, cont. . .

cake better has a greater effect in increasing the volume of the finished cake than addition of 10 percent of the older type of monoglyceride, DPI found in its baking experiments.

Improved properties of the distilled monoesters are primarily due to the high monoester content. But additional benefits are believed due to the absence of diesters, metallic soaps and residual catalyst, and to the low content of glycerine and free fatty acids. Previous commercial methods have been unable to separate all these substances effectively from the surface-active monoesters.

The DPI purification process also removes byproduct colors, odors and flavors; it results in higher melting monoester fats.

Monoglycerides of cottonseed oil, distributed by DPI under the trade name Myverol Type 18-85 Distilled Monoglycerides, are said to be the most powerful dispersing surface-active agents of their type. It is believed that the new product will have at least four times the activity of the older material in other types of cakes and baked goods. Analytical data are: glycerine content, 2.5 percent maximum; free fatty acid content (as oleic), 1.0 percent maximum; saponification value, 150-160; iodine value, 75-85; color (5¼-in. Lovibond), 15Y/1.5R maximum; melting point, 52 deg. C., 125.6 deg. F. (approximate); specific gravity, 0.93 at 60 deg. C.

Distilled monoglycerides of stearic acid have unusual emulsifying properties that should make them especially useful in the cosmetic and pharmaceutical industries.

*Distillation Products, Inc., 775 Ridge Road West, Rochester 13, N. Y.*

MOSTLY STEARIC ACID:

## Fatty Acids

Stearic acid content as high as 97 percent or more features a new series of fatty acids that is being supplied to industry by Atlas Powder Co.

The purification of stearic and other hard fatty acids from natural fats is accomplished by a basically new and exclusive process. The process, owned and operated by the Trendex Co. of Memphis, Tenn., yields finished products of a quality hitherto unobtainable in commerce.

The process, which is being fully covered by patents, was developed in the laboratories of the HumKo Co., vegetable oil processor, of Memphis. The HumKo Co. has no further interest in the Trendex process, however, except that it has contracted to supply basic raw materials.

Besides improved color, odor and taste specifications, the unsaponifiable matter in the new acids is as low as 0.1 percent and the average iodine value is well below 0.5. In addition, the acids show exceptional heat stability, so that when reacted with other materials they produce derivatives of superior quality.

Three high-purity hard acids, differing in uniform proportions of stearic and palmitic acids, are announced. They include 70, 80 and 97 percent stearic acids under the brand name of Hystrene, a trademark of the Trendex Co.

Atlas research work with the new acids shows substantial advantages for the production of high-quality products made with stearic acid.

The new fatty acids should find wide acceptance in the manufacture of cosmetics, pharmaceuticals, candles, metal stearates and various chemicals. In fact, the new series of acids should find uses in many industries already supplied by Atlas with sorbitol or surface-active agents.

Atlas plans to use Hystrene extensively in the manufacture of several of its own emulsifying agents, which include sorbitan stearates, their polyoxyethylene derivatives and polyoxyethylene stearates.

*Atlas Powder Co., Wilmington 99, Del.*

LESS HAZARDOUS:

## Acetate Cement

More efficient and far less hazardous than acetone, a new liquid cement for bonding cellulose acetate objects is now being introduced for the first time by Schwartz Chemical Co., Inc.

The new bonding agent was developed to answer a specific need for an effective adhesive that would be safer for industrial use than highly flammable acetone, which is considered a dangerous fire hazard even when stored in small quantities.

Called Acetate Cement, the new solvent mixture is said to be far less volatile than acetone, does not require a fire department permit, and can be stored safely in unlimited quantities.

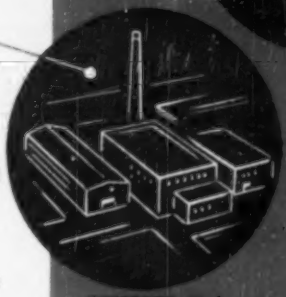
Schwartz engineers point out that highly volatile acetone often evaporates before it has an opportunity to soften, penetrate and firmly weld an acetate assembly. The new Acetate Cement, however, evaporates slowly enough to prevent blushing and to insure good penetration and a strong bond, reports the manufacturer.

The new development should be of interest to fabricators of a wide variety of acetate products, including toys, novelties, spectacle frames, displays,

(Continued)

# These 5 HEYDEN MODERN PLANTS

## give Industry and Science an assured source of QUALITY CHEMICALS




Benzaldehyde • Benzoates
Benzyl Chloride • Bromides
Chlorinated Aromatics
Chlorobenzenes • Creosotes
2,4-D • Formaldehyde • Formic Acid
Glycerophosphates • Guaiacols
Hexamethylenetetramine
Medicinal Colloids • Methylene
Disalicylic Acid • Paraformaldehyde
Parahydroxybenzoates
Penicillin • Pentaerythritols • Propyl
Gallate • Quadrafos • Salicylates
Salicylic Acid • Streptomycin

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This treatise on "Fletcher Modern High-Speed Centrifugals" may save your company money! It contains down-to-earth facts about Fletcher Centrifugals . . . how they operate . . . their construction . . . full details on the exclusive "Centroid" Speed Control, all fully illustrated. Write for it, today, on your business letterhead.

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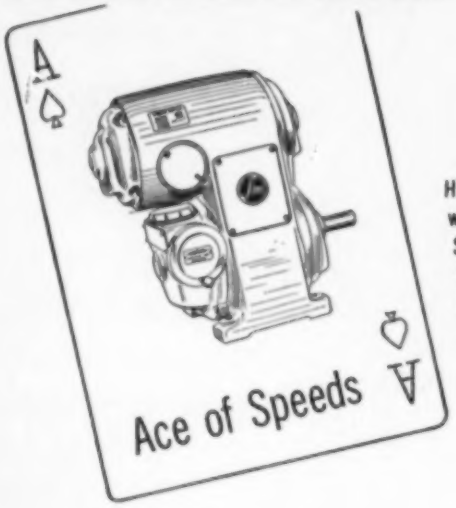


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SPEED-TROL (Variable Speed) • SLO-SPEED (Geared) • KLOSED (Normal Speed)




small electrical appliances and the transport wrapping materials that are used in packaging.

Described as water-white, free-flowing and non-toxic, the new acetate cement is available for immediate delivery in quart, 1- gal. and 5-gal cans, as well as in 55-gal. steel drums.

*Schwartz Chemical Co., Inc., 326-328 West 70th St., New York 23, N. Y.*

## Briefs . . .

**Kel-F**, the trifluoromonochloroethylene polymer, may soon be produced in suspensoid form for application by spraying, dipping or other coating methods. M. W. Kellogg Co. has had a suspensoid form of the high-temperature thermoplastic under laboratory study for some time, and will soon disclose full information. *M. W. Kellogg Co., 225 Broadway, New York, N. Y.*

**Citric acid** has found a new use as an economical and stable sequestering agent to prevent the precipitation of 2,4-D salts by hard water, according to Chas. Pfizer & Co., Inc. About ¼ oz. of citric acid per pound of 2,4-D included in the amine salt concentrate provides protection against precipitation in water of 1,000 ppm. hardness. Proportionally more citric acid is needed in harder waters. The metal ions in the water form complexes with the citrate, leaving the 2,4-D soluble to act with 100 percent efficiency as the active principle in the weed-killing formulation. *Chas. Pfizer & Co., 630 Flushing Ave., Brooklyn 6, N. Y.*

**Maleic anhydride** is now being offered by Monsanto in briquette form. This new molded form is designed for maximum ease and safety in handling as well as processing efficiency. Uniformity of the briquettes and the absence of dust and fines, which are screened out, make them particularly attractive to plant men. Moisture pick-up and subsequent hydrolysis are held to a minimum because of the small exposed surface per unit weight. There is no advance in price over the regular schedule for maleic anhydride in flake and fused forms. Principal use for maleic anhydride has been in the manufacture of modified alkyds, hard resins and non-yellowing drying oils. But the anhydride is finding other uses in the fields of pharmaceuticals, wetting agents and plastics. *Monsanto Chemical Co., St. Louis 4, Mo.* —*End*

# THESE TROUBLEMAKERS

IN PLANTS EQUIPPED with

**CASH STANDARD** *Streamlined* PRESSURE TYPE 1000 **REDUCING VALVES**

## THESE *Users* TELL WHY . . .

***A Conditioning Corp. writes—***

"Had a very critical job where it was important to HOLD CONSTANT PRESSURE TO VERY CLOSE TOLERANCES because we were using steam to reheat air to a set degree with allowed variation of less than one degree. Changed pressure reducing valves twice, then tried a CASH STANDARD Type '1000' and were able to accomplish the job."

***A Maintenance Engineer says—***

"I would be more than willing to recommend the performance of the CASH STANDARD Type '1000' Pressure Reducing Valve because we used the valve here UNDER ADVERSE CONDITIONS and found it PERFECT IN EVERY WAY—TROUBLE FREE and PRACTICALLY NO MAINTENANCE COSTS."

***A Supt. of a Public Utility says—***

"We operate a CASH STANDARD '1000' valve reducing steam pressure from 400 to 175 lbs. on our low pressure steam turbines' condenser air ejectors which is an important function and it has done the job WITHOUT FAILURE TO DATE."

***A Tobacco Co. writes—***

"We use only one '1000' valve in this department. It is used on the steam line to our Castle Autoclave (tough service). Our experience has been CONTINUOUS SMOOTH OPERATION for several years."

***An Instrument Co. writes—***

"Control of gasoline pressure on flo range of 5-4000 p. p. h. at 17½ psi. CONSTANT PRESSURE CONTROL over full range within 5%. This was on production test stands used for checking solid fuel injection on aircraft motors."

**WRITE FOR BULLETIN 962**

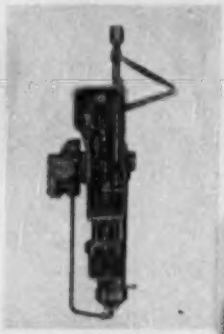
***Note the benefits*** users say they get from their CASH STANDARD Type '1000' Pressure Reducing Valves.

## *Check the benefits* with this list

1. **Maximum capacity when needed most.**
2. **Accurate pressure control under toughest working conditions.**
3. **Trouble-free service.**
4. **Smooth operation.**
5. **Tight closure.**
6. **Speedier production results.**
7. **Elimination of failures.**
8. **Cost-saving operation.**
9. **No spoilage.**
10. **Practically zero in maintenance.**

**BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES**

***Send for them***



Bulletin 962 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.

Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

**CASH STANDARD CONTROLS . . . VALVES**

**A. W. CASH COMPANY**
DECATUR, ILLINOIS

A CHEMICAL ENGINEERING PICTURED FLOWSHEET

# Potassium Chloride and Sulphate

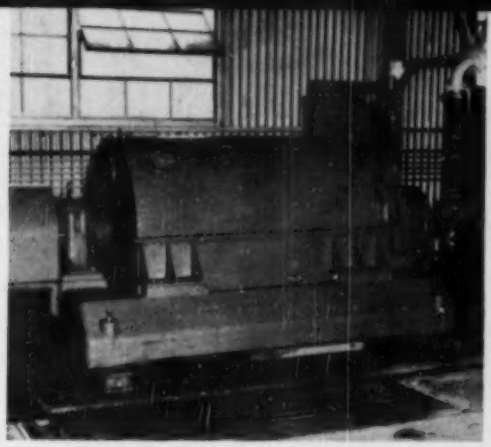
International Minerals & Chemical Corp. has combined the production of high purity potassium chloride with a new process for producing potassium sulphate at their mine and refinery in Carlsbad, N. M. The combination cuts down waste of impurities and facilitates tonnage production of 99.9 per cent KCl. Integration of the two processes has paid off in economics of installation and operation. By grouping the basic steps common to both processes, control is centralized and number of operators reduced to a minimum.

### MURIATE PROCESS

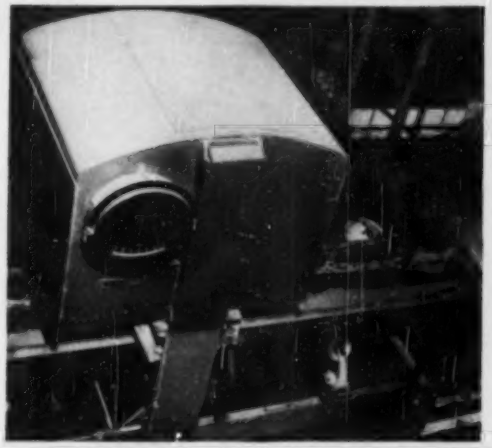
Raw material is damp muriate crystals from the flotation section of the muriate plant. They are repulped in KCl brine and washed in a centrifugal. The bulk of the effluent returns to the repulping step and some is bled back into the refinery brine system. The solids go to an agitating tank where a Weightometer controls the water added producing a KCl-$H_2O$ ratio equivalent to that of a KCl solution saturated at 80 deg. C. The slurry is next heated to 85 deg. C., in an evaporator to completely dissolve the salt. Then it is clarified in a Dorr clariflocculator, polished on a plate and frame filter, and cooled to 30 deg. in a two-stage vacuum crystallizer. Approximately one third of the KCl is precipitated, dewatered and washed in a centrifuge, dried in a rotary dryer and stored.

### SULPHATE PROCESS

The effluent is pumped to a series of three agitated tanks where it is mixed with finely ground langbeinite ($K_2SO_4$—$2MgSO_4$) and recycled salts from this same process. Solid potassium sulphate (95 percent $K_2SO_4$) is precipitated, separated in a centrifugal, dried and stored. The effluent is partially evaporated in a series of three evaporators and then cooled to 30 deg. C. in a two stage vacuum crystallizer. Resulting solids, a mixture of KCl and leonite ($K_2SO_4.MgSO_4.4H_2O$), are separated on a vacuum filter and returned to the reaction tanks. The filtrate for the present is disregarded.

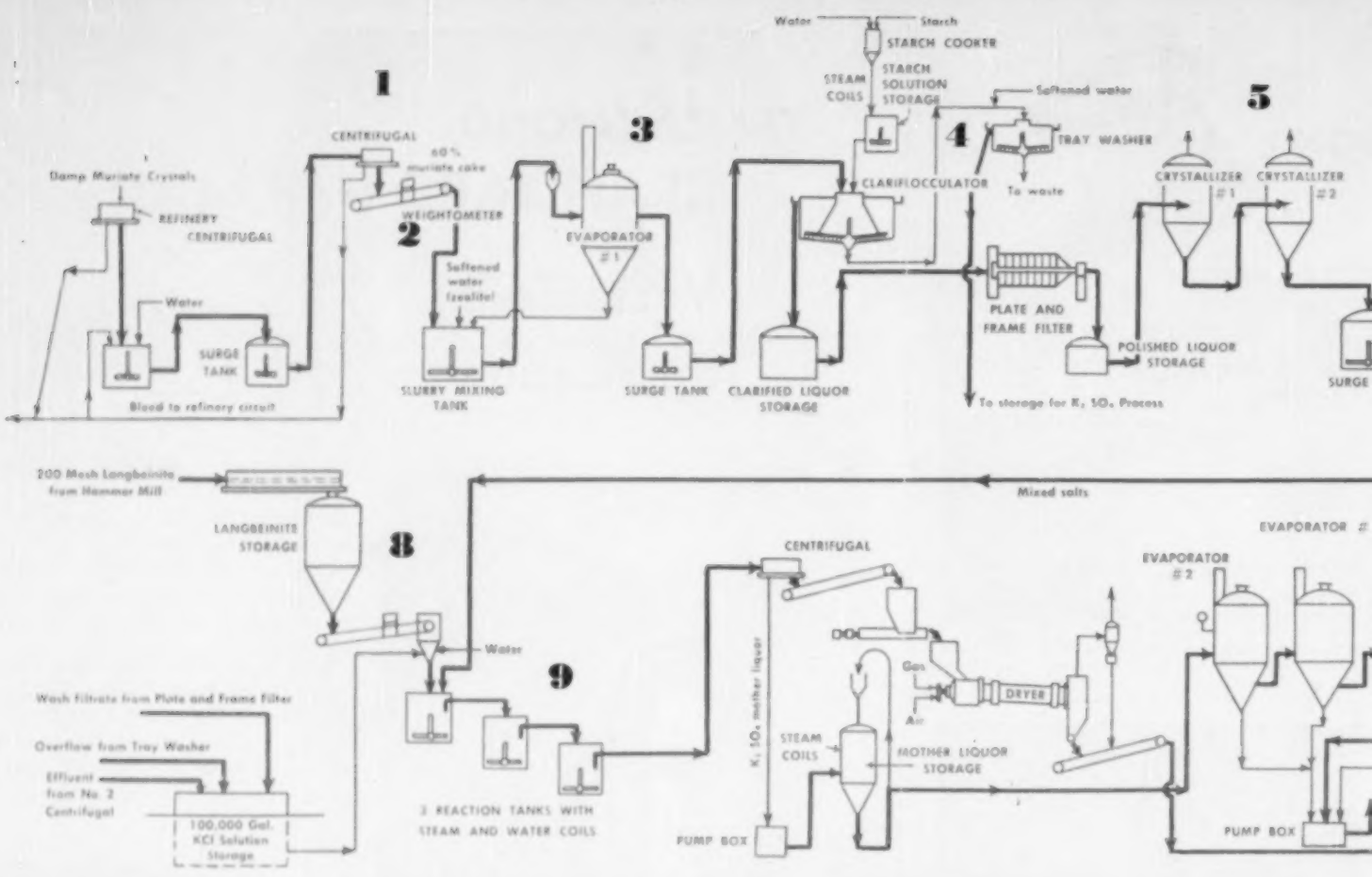


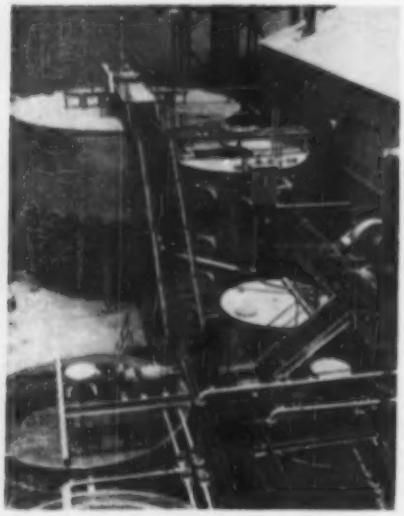
**1** REPULPED KCl is taken off by a continuous cylindrical centrifuge as cake. This gets a water wash.



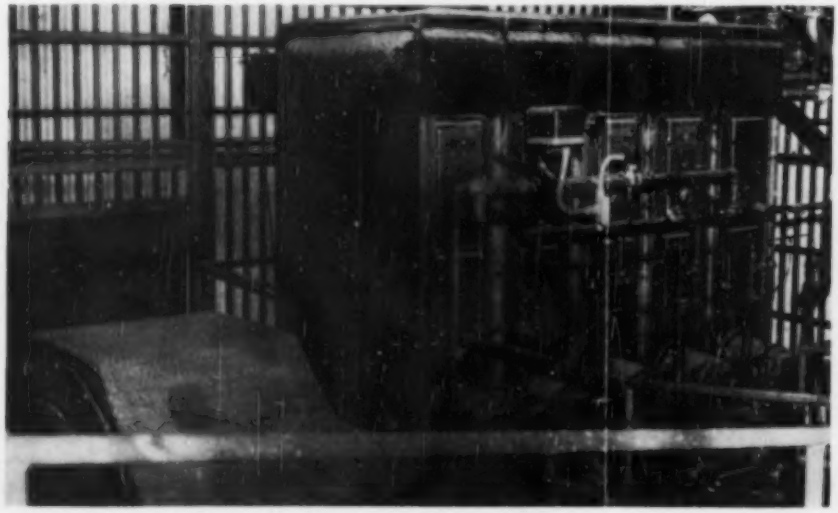
**2** KCl CAKE is measured by Weightometer. Controlled ratio of cake to water maintains proper KCl concentration.

**3** SOLUTION OF CAKE in water occurs in Ozark-Mahoning submerged combustion unit on right.



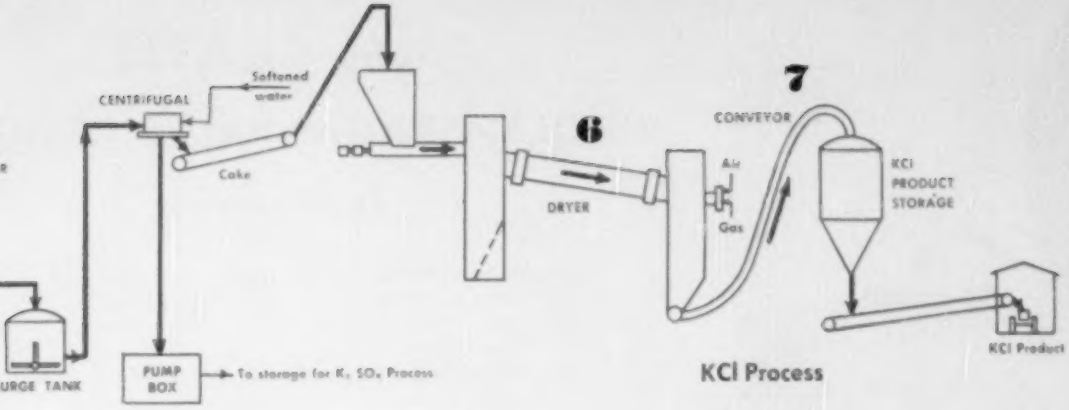



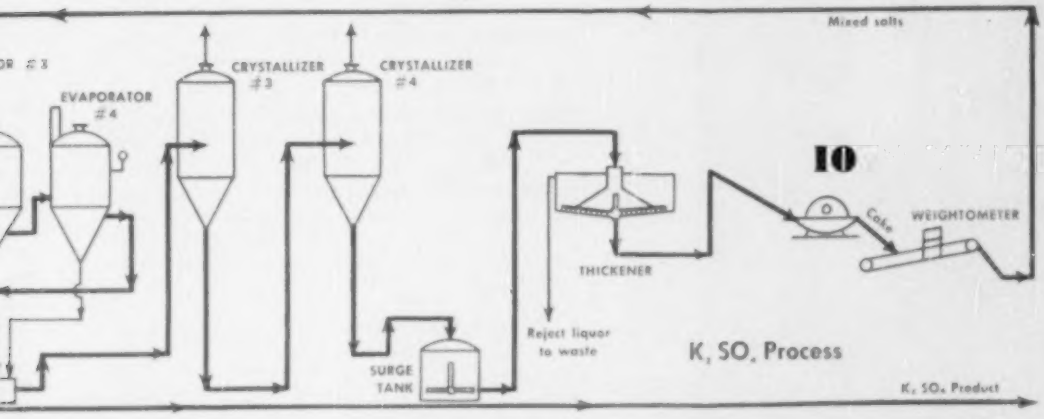
**4** INSOLUBLE SLIMES are coagulated in clariflocculator with starch solution.

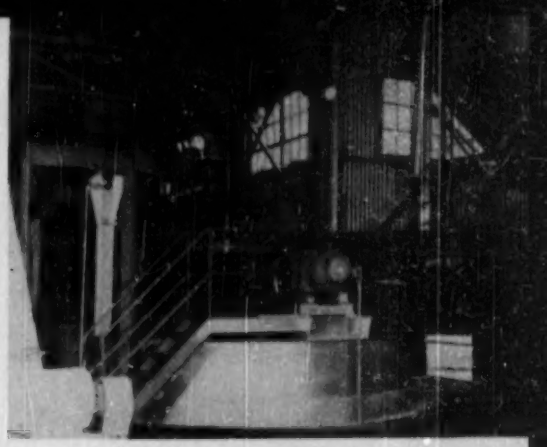


**5** CRYSTALIZED KCl comes from two continuous vacuum rubber-lined crystallizers in series. Bird centrifuges separate crystals from mother liquor and wash the KCl crystals.

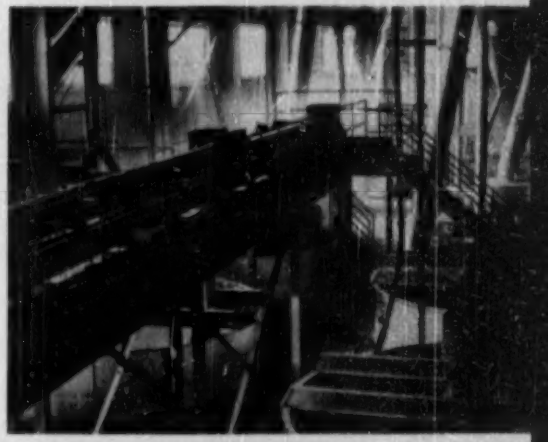
**6** DRIED CAKE comes fr
this gas interchange heate



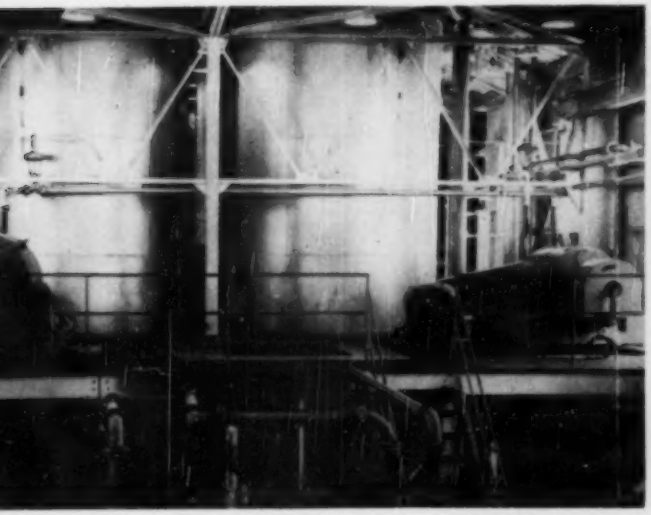



**8** LANGBEINITE is added to recycled salts and KCl mother liquor. Weightometer controls ratio.

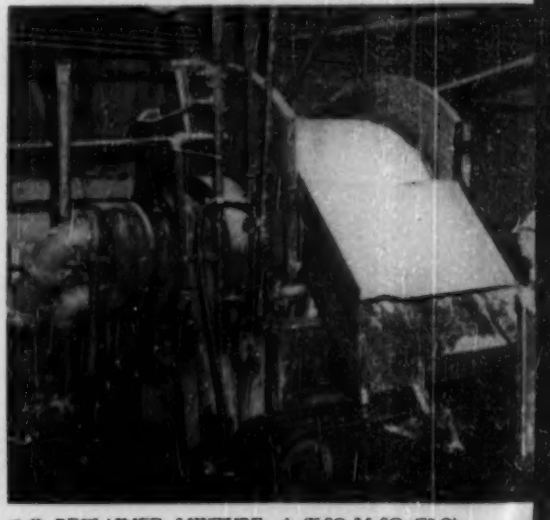


**9** POTASSIUM SULPHATE and $MgCl_2$ are formed as KCl reacts with langbeinite and leonite in tanks.



mes from a countercurrent rotary Monel-clad dryer. The air is indirectly heated in e heater. The finished product is ready for storage.

**7** REFINED KCl is placed in this 1,000 ton storage silo. Air conveyor brings it from dryer.



**10** RECLAIMED MIXTURE of ($K_2SO_4.MgSO_4.4H_2O$) and KCl is collected on filter and recycled.

# TO DETERMINE PROPER F x G

## Tolhurst VARIABLE SPEED Centrifugals

ILLUSTRATION SHOWS HYDRAULIC DRIVING UNIT WITH COVER REMOVED

### *Only Tolhurst Variable Speed Centrifugals provide*

- ★ Smooth stepless speed variation from 0 to 2150 RPM
- ★ Centrifugal force range up to 1700 times gravity
- ★ Available with interchangeable baskets, perforate or imperforate, 20" and 26" diameters
- ★ Basket speed indicator is standard equipment
- ★ Case can be jacketed for circulating steam or coolant
- ★ Can be furnished completely fume tight, as illustrated
- ★ Single speed motor can be open, totally enclosed fan cooled or explosion proof, as specified

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DO THESE **6** JOBS *Faster... More Economically*

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**LABORATORY SERVICE AVAILABLE**

TOLHURST MAINTAINS A WELL-QUALIFIED STAFF AND MODERN RESEARCH FACILITIES TO FURNISH CONFIDENTIAL, UNBIASED AND INTELLIGENT RECOMMENDATIONS ON YOUR CENTRIFUGAL PROBLEMS.

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# *why* CRANE DIAPHRAGM VALVE DES *is Superior*

**LONGER DIAPHRAGM SERVICE LIFE**—Diaphragm is not subject to cutting, crushing, and rapid wear since it is used *only* to seal the bonnet; not for seating purposes.

**POSITIVE SHUT-OFF** in case of diaphragm failure. *This is an exclusive Crane safety feature.*

**ACCURATE SEATING**—Circular flat face disc with resilient neoprene seating surface gives tight closure—independently of diaphragm—on all fluids.

**GREATER FLOW CAPACITY**—Y-pattern body design gives closer approximation to straight-line flow, reduces resistance and pressure drop.

**EASIER OPERATION**—Less torque— fewer turns—needed to operate valves—especially in larger sizes.

**PLAIN IRON OR NEOPRENE-LINED**—Unlined valves will handle all common services. Neoprene-lined valves are recommended for fluids corrosive to iron but non-active chemically upon neoprene.

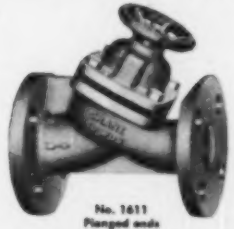
***SEND FOR THIS NEW CIRCULAR***

Contains complete information about these outstanding valves—including all essential specification data, service recommendations, and list prices. Ask your Crane Representative for your copy, or WRITE FOR CIRCULAR AD-1761. No obligation.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
*Branches and Wholesalers Serving All Industrial Areas*

***NOW AVAILABLE IN SIZE***

No. 1610
Screwed ends
½ to 2-in.



No. 1611
Flanged ends
½ to 6-in.

*EVERYTHING FROM . . .*

VALVES
FITTINGS
PIPE

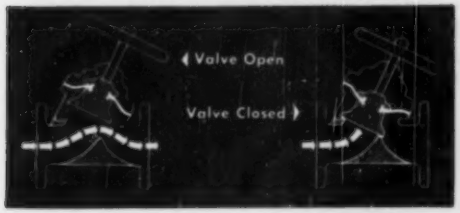
CRA

ESIGN

WORKING PRESSURES
150 Pounds
water, oil, air, or gas
½ through 4-in. sizes
125 Pounds
water, oil, air, or gas
6-in. size only
180 Deg. F.
max. temp.; all sizes

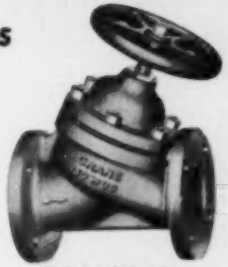
**HOW IT WORKS**

The Crane diaphragm performs one job only—sealing the bonnet against line fluids. The sealing member is a separate circular flat face disc, firmly attached to the stem and joined to the diaphragm with a special leakproof connection. This independent sealing arrangement permits positive shut-off of flow, even in case of diaphragm failure.




SIZES UP TO 6-INCHES

No. 1613
Neoprene-lined, Flanged ends
½ to 6-in.



2½, 3, 4, and 6-in. valves, Plain iron or Neoprene-lined, have rising, turning stem

ANE

PLUMBING
AND
HEATING

FOR EVERY PIPING SYSTEM

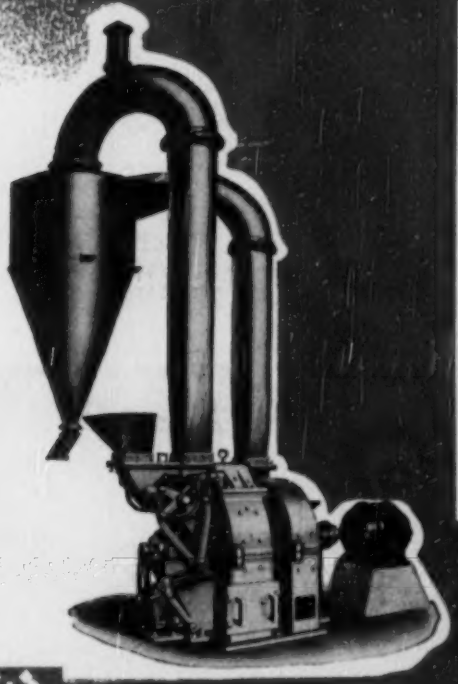




*The* **RAYMOND**
**STANDARD IMP MILL**

Versatile in application

**FLEXIBLE in INSTALLATION**



The Raymond Imp Mill is a compactly built unit that is especially adapted for use in the chemical and process industries. It requires comparatively little floor space and is used for pulverizing a wide variety of materials.

This equipment can be designed and arranged to fit any plant layout. The Imp Mill handles the material in a closed, dustless system, and it provides a clean, low cost method of grinding chemicals, dry colors, filter cakes, phosphate materials, and many similar products.

Adjustable for a wide range of finenesses, depending upon the particular material, Raymond Imp Mills are built in a number of different sizes for almost every capacity requirement. The smallest Imp Mill, the versatile #0000, is well suited to experimental and pilot plant work.

SINCE 1887

**COMBUSTION ENGINEERING - SUPERHEATER, INC.**
**RAYMOND PULVERIZER DIVISION**
**1311 North Branch Street, Chicago 22, Illinois**

# Chemical Engineering News

JOSEPH A. O'CONNOR, News Editor

## New Stabilization Process For Guncotton a Timesaver

Research workers at the U. S. Department of Agriculture's Southern Regional Research Laboratory, New Orleans, have devised a new method of stabilizing guncotton that will permit powder factories to be smaller and thus less vulnerable to air attack in event of war.

Removing all traces of the sulphuric acid used as a catalyst in nitrating cellulose is difficult and the conventional procedure for purifying and stabilizing the explosive is long, laborious and expensive.

The new procedure takes much less time and requires much smaller operating space and less fuel than the conventional process. It removes most of the sulphuric acid by washing and boiling, as in the usual method, but in one-third to one-fourth the usual time; that is, in 20 hr. instead of the customary 60 to 80 hr.

All remaining traces are then neutralized quickly with ammonia, a procedure which makes further boiling of the guncotton unnecessary.

## AEC Authorizes Production Of Uranium for Research

The Atomic Energy Commission has authorized production of 200 lb. of uranium metal for use by private laboratories under AEC license.

The metal, which will retail for about $50 a lb., will be specially produced and fabricated in the form of rods by the Mallinckrodt Chemical Works, St. Louis, Mo., and distributed by this company through normal commercial chemical channels.

The uranium, highly refined, is of particular value in metallurgical studies and other general research uses. Industrial laboratories, universities and other private research groups have wanted it for some time for special studies. Although the metal will be relatively pure, AEC pointed out that it will not have the extreme purity required for nuclear reactors and certain secret types of atomic energy research.

Uranium metal has a density 18.7 times heavier than water; it is ductile and about as hard as iron. It is regarded as an important tool in studying the properties of metal under conditions of extreme low temperature.

For example, in the study of superconductivity at temperatures close to absolute zero, scientists hope to discover more about the behavior of atoms and atomic forces. An electric current set up in a material whose temperature has been reduced to the point of super-conductivity will continue to flow perpetually. Since the material offers no resistance to the flow of current, no heat will be released.

Another use of uranium metal is to "shadow-cast" specimens under study in electron microscopes. Objects in the specimen are coated in a vacuum with a thin film of uranium deposited obliquely. Because of the high density and atomic weight of uranium, an excellent shadow of the specimen, with good contrast, is cast when it is bombarded with electrons.

In accordance with the provisions of the Atomic Energy Act of 1946, an AEC license will be required of all purchasers of the uranium metal. A license will be granted if there is an assurance that the materials will not be used in a manner that would be detrimental to the national welfare or injurious to the health and safety of individuals working with the metal.

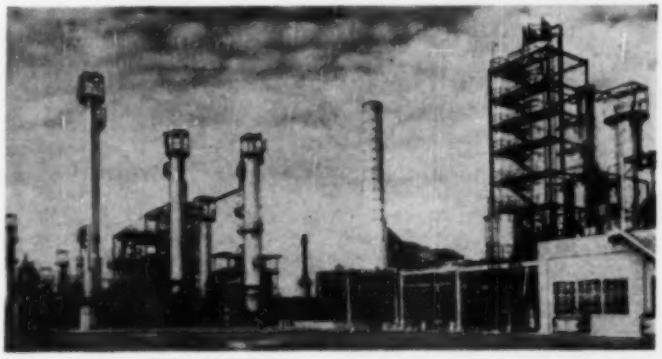
Inquiries concerning the availability of uranium metal for research purposes should be directed to: Licensing Division, U. S. Atomic Energy Commission, New York Operations Office, P. O. Box 30, Ansonia Station, New York 23, N. Y.

## Chemical Orphan Envisioned As Likely Fuel for Rockets

Nitrogen tetroxide, long an orphan among chemicals despite its potential abundance, now promises to be adopted by the U. S. as one of the strongest of its rocket fuel resources. Its high oxygen content makes nitrogen tetroxide a natural for use as an oxidizer in rockets, which must carry their own oxygen supply to fire other propellants such as gasoline or alcohol.

Should continuing tests of military and private research groups create a high demand for nitrogen tetroxide, the U. S. would be able to turn out 500,000 tons a year by converting only 10 percent of total ammonia output to nitrogen tetroxide. That's what Douglas H. Ross told members of the American Rocket Society, an ASME affiliate, holding their fourth annual convention in New York in December.

(Continued)



UNITS AT NEW EAGLE POINT, N. J., REFINERY OF TEXACO

**At right is furfural refining unit. Texas Co. developed the furfural process for removing impurities from oils by a solvent made from oat hulls. It is now widely used. Center towers make up thermal reforming unit, which takes low-grade gasoline as charge, heats cuts to 1,000 deg. F. under 750 psi., produces a higher-octane product. At far left is the catalytic polymerization unit, which takes products from cat cracker as charge, transforms them into high-octane blending stocks.**

Ross, who is with the Solvay Process Division of Allied Chemical & Dye Corp., is assistant manager of Solvay's product development department.

Laboratory experimentation with nitrogen tetroxide has been going on for over 75 years. But it lost its orphan status only recently as it became readily available at low cost.

Rocket experiments involving nitrogen tetroxide have been under way by the Army, Navy and Air Force, as well as by universities and private rocket firms, for years in an attempt to utilize this highly active, abundant chemical.

Nitrogen tetroxide was used in the JATO (jet-assisted takeoff) unit when liquid propellants were employed to get longer intervals of thrust than was being provided by solid fuels. Its success in these early trials sparked the more intensive research that is still under way. Primary research work on these JATO units was initiated at the Guggenheim Aeronautical Laboratory of the California Institute of Technology.

Containing about 70 percent oxygen, nitrogen tetroxide is a powerful oxidizer, capable of releasing all its oxygen even under the rigorous conditions encountered in a rocket motor.

As an efficient oxidizer, nitrogen tetroxide is of most value to the rocket engineer. As examples of this fact, Ross cited the successful explosives developed in France and the United States, a practical Peruvian rocket motor and a drop bomb, all of which employ nitrogen tetroxide. Explosives compounded with nitrogen tetroxide are useful due to their high heats of explosion and extremely high explosive wave velocities.

Chief among the physical and chemical characteristics that make nitrogen tetroxide such a valuable oxidizer for rocket fuels are its (1) high chemical stability, (2) high density, (3) low freezing point, (4) reasonably low vapor pressure, and (5) lack of susceptibility to decomposition.

Other points in favor of nitrogen tetroxide are its low cost, availability, controllable corrosion behavior and high energy content. Nitrogen tetroxide, although corrosive to steel when wet, can be stored satisfactorily in steel containers when dry.

Comparing rocket fuels on the basis of pounds of thrust obtained per pound of fuel consumed per second, nitrogen tetroxide possesses more energy than hydrogen peroxide, red fuming nitric acid and mixed acid. Helpful in rocket design is the high density of nitrogen tetroxide, which would permit small, compact fuel tanks.

Outside the field of rocket development, experiments with nitrogen tetroxide indicate that it may be useful in developing new organic products. It has been used to form dinitro compounds that are useful in explosives. Also, nitrogen tetroxide may be employed in nitrating organic compounds and has been used for the nitration of benzene, toluene and aliphatic hydrocarbons.

**PAINT EXPERTS CHARMED BY PETITE PARISIENNE**

**Her Gallic charm, as well as her knowledge of protective coatings, has completely won over these gentlemen. Here Leo Roon, president of Noodex Corp., and Carlton H. Rose (bow tie) of National Lead Co., past president of the Federation of Paint & Varnish Clubs, join the host Max Kronstein (extreme right), research associate in chemical engineering at New York University, in welcoming Mlle. Marguerite Caillaux of the Societe Francaise Duco, Paris, to the university's second annual symposium on paint and varnish chemistry. Mlle. Caillaux is a prominent member of the newly formed European Federation of Varnish & Paint Chemists. Roon and Rose are members of the industrial advisory committee for NYU's paint project, which is directed by Dr. Kronstein.**

## Pure Acetone Cyanhydrin Goal of Process Changes

Rohm & Haas will shortly make some alterations in its Houston, Tex., plant. Approximately $300,000 will be spent to put in a new boiler, high vacuum distillation column and other equipment.

Net result will be, not an increase in production, but rather a final product, acetone cyanhydrin, of 100 percent purity, instead of one containing several percent water as at present.

## AIChE Plans Top Program For Its Houston Meeting

The Houston, Tex., regional meeting of the American Institute of Chemical Engineers will be held at the Rice Hotel, February 26-28 and March 1, 1950. In preparing the technical program for the meeting, Mark Hopkins and K. A. Kobe, chairmen of the program committee, have taken into account the diversity of technical interests of engineers in the Southwest. The program calls for papers on phase equilibria, waste disposal, ultrasonics, technology of the chlorine-caustic industry and on other topics.

Harold W. Danser will consider in detail applications of ultrasonics in the chemical industry. W. H. Jansen will present graphic data on methods and equipment required for generating ultrasonic energy.

Charles F. Hauck will deal with pollution abatement and industrial water management. E. L. Demarest and W. D. Kohlins will present examples of the use of equipment for the solution of specific waste disposal problems.

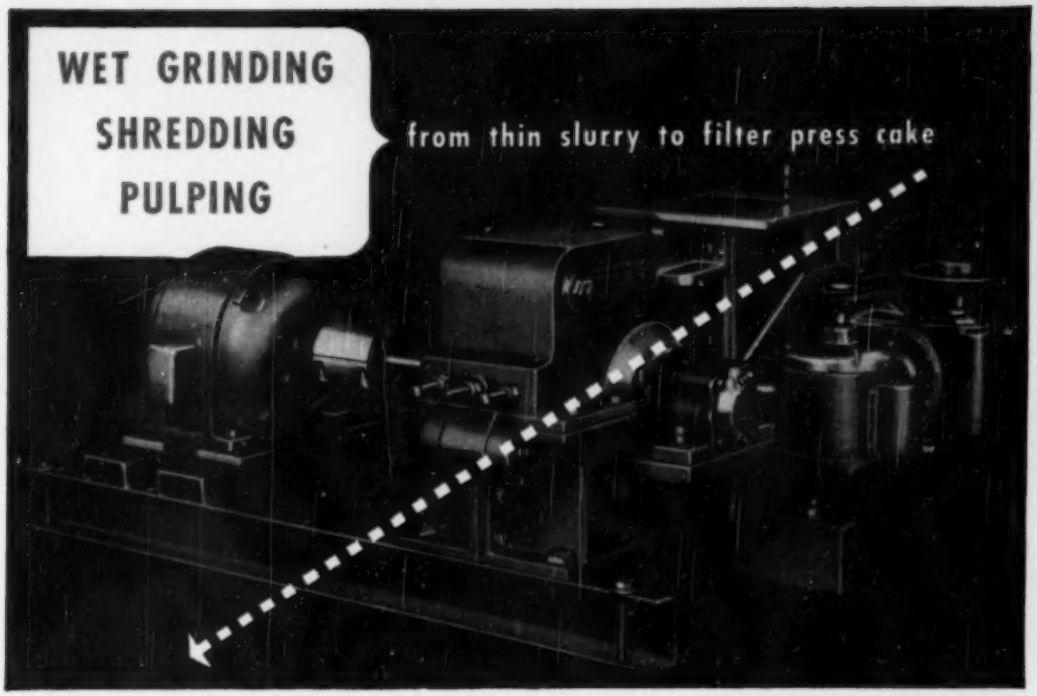
D. O. Hubbard will discuss optimum operating currents for Hooker type S cells. R. B. MacMullin has agreed to tell about byproducts of the amalgam type chlorine cells. W. L. Badger will describe use of Dowtherm in producing high concentrations of caustic. Robert M. Crawford has chosen chlorination of organics by HCl and air as his topic. And Charles P. Roberts will talk on the copper chloride cell process (chlorine from HCl).

W. A. Pennington will offer an evaluation of a new refrigerant. Diffusion rates in the extraction of porous

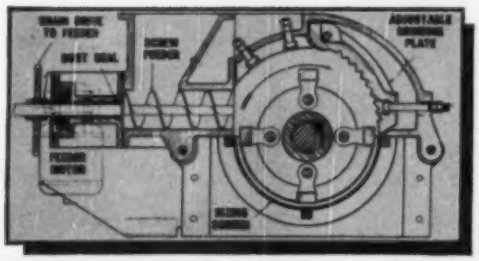
(Continued)

WET GRINDING
SHREDDING
PULPING

from thin slurry to filter press cake



WILLIAMS
# HELIX-SEAL HAMMERMILL




Sectional view of Helix-Seal Mill. Note long grinding plate against which the material is ground before it reaches the sizing screen. This plate is adjustable to compensate for wear.

**WILLIAMS ALSO MAKES . . .**

Heavy-duty hammermills; impact and roller mills for 200 to 325 mesh grinding; drier mills; air separators; vibrating screens; steel bins; complete "packaged" crushing and grinding plants.

Williams Mills are used by many plants for the handling of wet materials . . . from thin slurry to filter press cake. When required, special construction is supplied to overcome corrosive reactions or friction hazards. Typical applications are:

- Refining wood pulp screenings when washing through mill with a large volume of water
- Flushing industrial wastes through grinder into sewage disposal system
- Shredding cellulose acetate when suspended in process liquor
- Reducing vegetables and fruits to pulp
- Shredding food-packing plant refuse preparatory to drying for stock feed
- Crushing crude ore and rock when part of a wet processing system

Specific information about individual requirements will be sent gladly upon receipt of inquiry supplying details of your grinding, crushing or disintegrating problem.

**WILLIAMS PATENT CRUSHER & PULVERIZER CO.**
2706 N. NINTH STREET — ST. LOUIS 6, MO.
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WILLIAMS

CRUSHERS — GRINDERS — SHREDDERS

*New*

**FLEX-a-FOAM Filter Mask**

**Dust Protection**

**Your Workers Welcome**

**and WEAR**

Simple construction (only four interlocking parts), breathing ease and attractive styling of the new Flex-a-Foam Filter Mask assure real wearing acceptance by your workers.

Featherweight positive-locking frames of molded plastic adjust themselves with comfortable snugness to every size face. Of DuPont Polythene, frames are so tough they're unbreakable in normal usage.

Flex-a-Foam's filter is a honeycomb construction of whipped foam latex – keeps out non-toxic nuisance dusts as small as 1/25000 of an inch! It holds its shape and can be washed in warm, soapy water for long sanitary usage. It's easier to breathe through than an ordinary pocket handkerchief!

Headband of molded natural rubber with exclusive method of adjustment that keeps mask snug and comfortable – no tension or hair pulling.

Workers enjoy its comfort, and you like the efficiency and economy of Flex-a-Foam, lowest priced *quality* respirator ever made. Send $1.50 for postpaid single mask.

**ATTENTION AGENTS AND JOBBERS**

***Your interest is invited***

The Goggle Parts Company — Dept. B.
Cleveland 13, Ohio

*Please send full information and prices on Flex-a-Foam Filter Masks.*

Name .....

Position .....

Company .....

Address .....

City ..... Zone ..... State .....

**THE GOGGLE PARTS COMPANY**

**CLEVELAND 13, OHIO**



solids will be dealt with by W. P. Armstrong. The graphical solution of steady state countercurrent transfer problems will be considered by E. B. Fitch. Process potentials of the centrifuge will be evaluated by C. M. Ambler. M. T. Howerton will deal with reaction rates in butane-isobutene-sulphuric acid systems. A discussion of graphical solutions for extractive and ternary distillation problems by J. M. Chambers is slated for the general session.

Trips will be made to plants of Humble Oil & Refining Co., Shell Oil Co., Sheffield Steel Co., Diamond Alkali Co., Mathieson Chemical Co., Champion Paper & Fibre Co., Consolidated Chemical Industries, Lone Star Cement Co. and Goodyear Synthetic Rubber Co.

A feature of the meeting will be the informal discussion groups on Monday evening, February 27. R. L. Murray of Hooker Electrochemical Co. will lead a discussion on training of chemical plant supervisors. William P. Schambra of Dow Chemical Co. will carry on a session on protective coatings for use in chemical plants. Sidney D. Kirkpatrick of *Chemical Engineering* has promised to air the question of what is news. Carl F. Prutton of Mathieson Chemical Co. will lead the panel on the relations of the universities and industries in educating and training chemical plant technical personnel.

For those planning to visit Mexico and Cuba, tours have been arranged to Mexico City and Havana.

## Big Turnout Expected for Chicago Show This Fall

To run concurrently with the 118th national meeting of the American Chemical Society, the Sixth National Chemical Exposition, to be held in Chicago, Sept. 5-9, 1950, is expected to draw record attendance, according to Marvin C. Rogers. Dr. Rogers is chairman of the exposition committee of the Chicago Section of the ACS, which sponsors the biennial show.

The 118th national meeting of the ACS in Chicago next year will have an attendance of over 10,000, so it is expected that over 50,000 persons will attend the exposition.

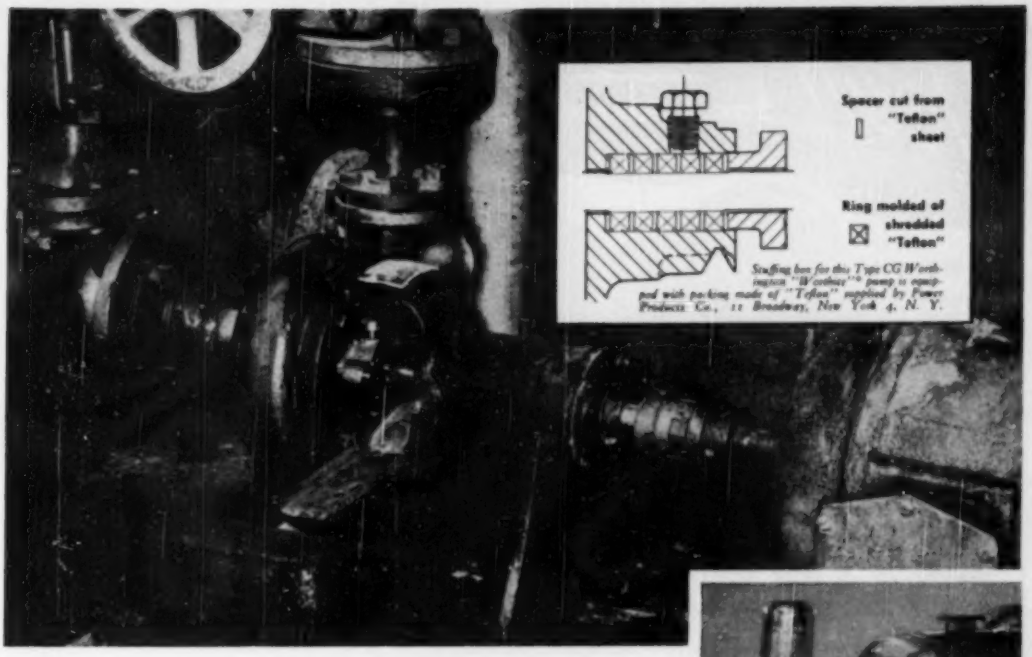
New manager of the exposition will be James J. Doheny, who was recently appointed section manager of the Chicago Section of the ACS. Doheny has been in charge of arrangements for the national meetings of ACS since 1946.

More than 200 industrial exhibitors will display new products and equipment at the 1950 show in Chicago. Other highlights of the exposition will be the National Chemical Industrial Conferences, which will air problems

(*Continued*)

**HIS ACHIEVEMENTS WIN HIGHEST ACCOLADE**

**Mott Souders, Jr., head of chemical engineering research for Shell Development Co., receives from John D. Fennebresque, manager of the chemical division of Celanese Corp. of America, the professional progress award for 1949, top honor of the American Institute of Chemical Engineers. Presentation took place at Hotel William Penn during Pittsburgh meeting of AIChE.**


Spacer cut from "Teflon" sheet
Ring molded of shredded "Teflon"
Stuffing box for this Type CG Worthington "Bi-rotor"® pump is equipped with packing made of "Teflon" supplied by Power Products Co., 11 Broadway, New York 4, N. Y.

# PACKING OF DU PONT "TEFLON"* LASTS UP TO 300 TIMES AS LONG

## as conventional packing in pumps handling highly corrosive chemicals

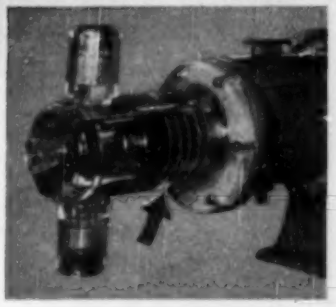
"We use pumps to handle fuming sulfuric acid and used to repack them every two days," reports one manufacturer. "In 1947, we packed our pumps with 'Teflon.' We haven't had to repack them since." This is a typical example of the extraordinary chemical-resistance of Du Pont "Teflon" tetrafluoroethylene resin.

**Stands temperatures from –320°F to 500°F.**

In addition to withstanding the attack of practically all chemicals except molten alkali metals, "Teflon" exhibits remarkable heat-resistance . . . can be used over a temperature range of –320°F. to 500°F. These characteristics, plus its extremely low coefficient of friction, account for the outstanding performance of packing made of "Teflon" in the pumping of such corrosive chemicals as saturated ethylene diamine tartrate solution, nitric acid, hot phosphoric acid carrying char in suspension, acetic acid and solvent mixtures, butyl extract, Glauber's salt-$H_2SO_4$ slurry, and tall oil-$H_2SO_4$. In every case, "Teflon" far outlasted any other packing material tried.

**Have you a problem "Teflon" can solve?**

"Teflon" is supplied by Du Pont in standard shapes (rods, tubes, sheets and tape). Or we will recommend molders or fabricators who can supply finished parts of "Teflon." Write today for more information. Our technical staff will be glad to help you. E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department (Consolidation of Plastics and Ammonia Depts.), Plastics Sales Offices: 350 Fifth Avenue, New York 1, N. Y.; 7 S. Dearborn St., Chicago 3, Ill.; 845 E. 60th St., Los Angeles, California.



**HERE YOU CAN ACTUALLY SEE** the packing of "Teflon" in a small proportioning pump with a stuffing box of Du Pont "Lucite"* acrylic resin. Like the packing in the Worthington pump, this packing consists of rings of molded shredded "Teflon" (dark rings) and spacers cut from "Teflon" sheets (white rings). Pump is manufactured by Proportioneers, Inc., 29 Codding Street, Providence 1, R.I.

*REG. U. S. PAT. OFF.

DU PONT
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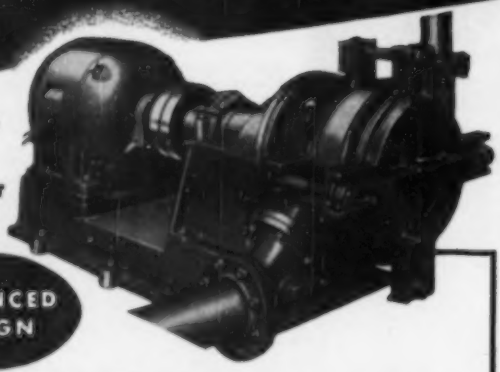
Plastics
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Now! A Durable Pump for Caustic Liquors

that operates for years without major replacements



ADVANCED DESIGN

MORRIS TYPE "R" LIQUOR PUMP

In most of the largest mills Morris liquor pumps are considered the standard—and have been so regarded for several decades. Now Morris continues to maintain its leadership with the durable Type "R"—especially engineered to handle black, green and white liquors, as well as any liquid containing abrasive solids and chemicals in suspension . . . with less wear, less maintenance and lower operating costs.

Here's Why the Durable Type "R" Is Easier to Install and Maintain

1. Shell is interchangeable for left- or right-hand rotation.
2. Suction and discharge nozzles can swivel to any of 72 different positions.
3. Impeller can be removed without disturbing the suction and discharge piping or the bearings.
4. Worn clearances on the suction side of the impeller can be closed in a few minutes simply by turning four adjusting screws.

And Here's Why the Durable Type "R" Provides Longer Service

- Heavier wear-resisting parts — designed for exceptionally long life.
- No internal studs or bolts — caustic liquors cannot seep past threads and cause maintenance headaches.
- Low pressure stuffing box — since the gland is under suction pressure only, most packing troubles are eliminated.
- Suction disc liner — to minimize wear, an extra heavy liner is provided between the suction disc and impeller.
- Interchangeable parts — pump parts of different alloys may be substituted to compensate for changes in the corrosive or abrasive action of the materials handled.
- Fewer wearing parts.

There is a Morris Pump particularly suited to your requirements. Send today for FREE specifications and operational data.

MORRIS CENTRIFUGAL PUMPS

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
Sales Offices in Principal Cities


News, cont. . .

of the process industries, and the Chemical Trail Blazers, featuring new advances in chemistry.

## CSC Shipping Chemicals Via All-Water Route

With the reopening of the Ouachita River in Louisiana to navigation, Commercial Solvents Corp. has inaugurated the shipment of chemicals by water transportation for the first time since the war.

The first such shipment, consisting

(Continued)

### CONVENTION CALENDAR

Compressed Gas Association, Waldorf-Astoria Hotel, New York, January 23-24.

Southwest Air Conditioning Exposition, Fair Park, Dallas, Tex., January 23-27.

American Society of Heating & Ventilating Engineers, 56th annual meeting, Dallas, Tex., January 23-27.

American Standards Association, seminar on industrial standardization, Engineering Societies Building, New York, January 23-27.

Association of American Soap & Glycerine Producers, Plaza Hotel, New York, January 25-26.

Salesmen's Association of the American Chemical Industry, Roosevelt Hotel, New York, January 26.

Chemical Market Research Association, Statler Hotel, Detroit, February 2.

American Institute of Mining & Metallurgical Engineers, annual meeting, Hotel Statler, New York, February 12-16.

National Council for Stream Improvement, annual meeting, Waldorf-Astoria Hotel, New York, February 20-22.

American Institute of Chemical Engineers, regional meeting, Rice Hotel, Houston, February 26-March 1.

American Society for Testing Materials, committee week and spring meeting, William Penn Hotel, Pittsburgh, Pa., February 27-March 3.

Southern Paint & Varnish Production Club, Peabody Hotel, Memphis, Tenn., March 8-10.

Drug, Chemical & Allied Trades Section, New York Board of Trade, 24th annual dinner, Waldorf-Astoria Hotel, New York, March 9.

American Chemical Society, 117th national meeting (divided), Houston, March 26-30, Philadelphia, April 9-13, Detroit, April 16-20.

American Drug Manufacturers Association, Boca Raton Club, Boca Raton, Fla., March 27-30.

National Plastics Exposition, Navy Pier, Chicago, March 28-31.

American Wood Preservers Association, annual meeting, Rice Hotel, Houston, April 25-27.

# You can't beat this MIXCO Agitator for—

## 1 Versatility USE IT FOR—

- open tanks
- closed tanks
- top entering
- bottom entering
- direct connection
- V-belt drive
- Quick Detach

## 2 Economy

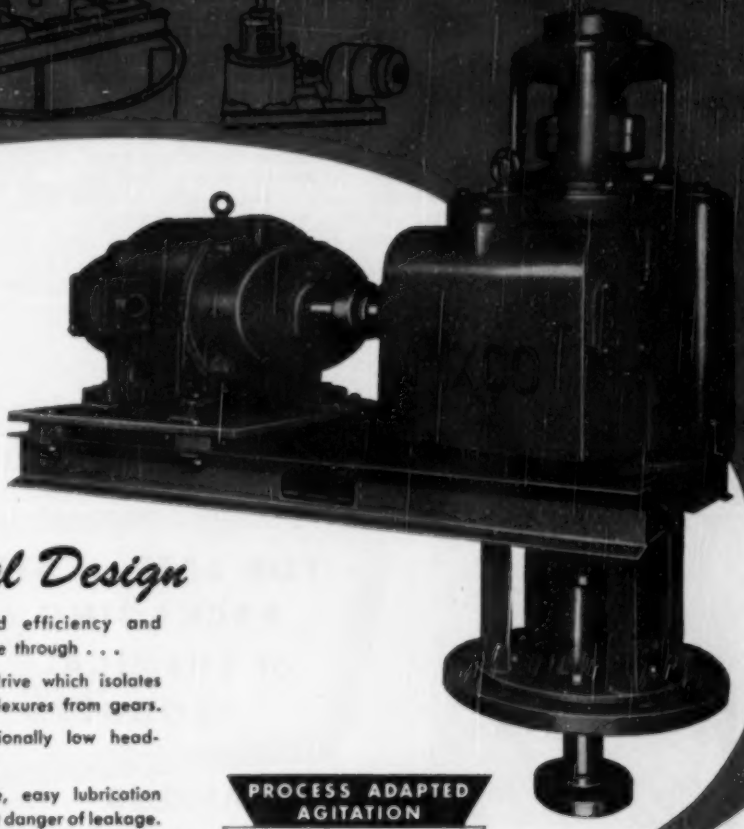
It's a Complete Package (self-supporting, factory aligned).

*You Simply—*

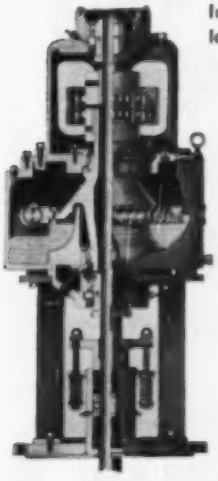
Remove from the shipping case.

Lower onto tank and bolt into place.

Connect current and start operating.



## 3 Mechanical Design



Increased efficiency and longer life through . . .

New drive which isolates shaft flexures from gears.

Exceptionally low headroom.

Positive, easy lubrication without danger of leakage.

Standard spare parts stocked for immediate shipment.

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Tough yet Gentle

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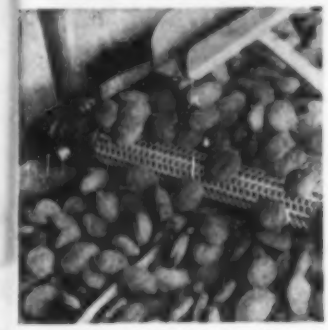
**Combine Movement with Processing Through Fire or Water**

Cambridge Wire Belts shrug off extremes of temperatures, corrosive agents, torsion, strain and wear. They hustle rough, bulky objects through the most rigorous treating processes, or convey delicate products with maximum safety.

Tempering, quenching, washing, baking, sizing, sorting, packaging, glazing: throughout industry, Cambridge Wire Belts are working at nearly every bulk material processing job. Each of these Cambridge Belts is fabricated in the proper mesh, weave, metal or alloy to do the job better, faster, safer and more economically.

**Let a Cambridge Field Engineer help you secure these advantages for your operation.**



*A chain drive Cambridge Balanced Belt carries soap-impregnated, steel wool pads from the drying oven. Open mesh assures free circulation of hot air and promotes cleanliness by allowing loose particles to sift through.*

**Write for FREE copy of the 130-page, illustrated Cambridge Wire Belt Catalog. It's an education in belt and conveyor design, application, installation and operation.**

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News, cont. . .

of 250,000 gal. of methanol, has just been made by tanker barge from CSC's plant at Sterlington, La., to New Orleans. The chemical will be transshipped by tanker at New Orleans to points on the eastern seaboard. Several trips a month are planned.

CSC's methanol plant at Sterlington, completed at a cost of $4.6 million, has dock-loading facilities. Located on the Ouachita River, which leads to the Mississippi, the plant has easy access by water to northern and eastern sections of the country.

Methanol produced by Commercial Solvents is used by the company in the compounding of anti-freeze. It is also used for producing formaldehyde, amines and other CSC chemical products, as well as being marketed to other industrial users.

## Georgia Chemical Plant Pushes Modernization

Chemical Products Corp., Cartersville, Ga., has completed a major part of its modernization program. The program started early last summer following an explosion and fire in the plant.

Fred Lester, general manager, explains that the plant was shut down part time during the summer so that new installations could be put in. New centrifuges, pumps, tanks and other equipment have been installed.

Production has been streamlined and procedures have been changed to increase output.

The entire program of modernization will be completed some time next spring, according to Lester.

## Two Fires in One Month Sweep Humble Oil Units

Fire, caused by a lead burner's torch, destroyed six units in the spent acid recovery department of Humble Oil & Refining Co.'s Baytown, Tex., refinery on November 28. Routine repairs were being made to some of the lead equipment when the accident occurred.

The fire has not interrupted production at the refinery. By mid-December a decision had not yet been reached on whether recovery units of the same type as those burned down would be installed.

Earlier, on November 16, another fire of an undetermined cause had destroyed a new $230,000 cooling tower at Humble's gas recycling plant near Katy, Tex. This mysterious blaze

(Continued)


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***Multi-Wall BAGS***

Hammond Betterbags safeguard the purity of your chemicals, and at the same time provide an attractive, easy to handle package for your products. Furnished in sewn, pasted, open mouth and valve style, in sizes to suit your needs. Write for quotation.

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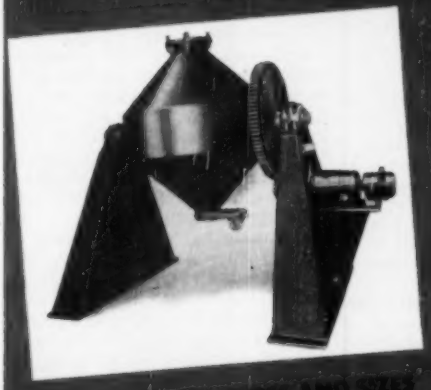
# International DRY BLENDERS

The Standard of Lower Blending Costs for Hundreds of Chemical Products

With all of the Features you have been looking for—



MADE IN MANY TYPES AND SIZES

These Conical Blenders range in capacity from 35 pounds to 100,000 pounds for materials having densities of from 20 pounds per cubic foot to 100 pounds and over per cubic foot.

For more rapid and efficient blending of any free flowing solid ranging from very fine mesh powder to large pebbles,—particularly for the intimate mixing of Pigments, colors and dyestuffs—Resin and plastic powders—Pharmaceuticals and medicinals—Food and Grain products—Photographic materials—Fine and heavy chemical powders—Fertilizers—Ore or metallurgical products.

**"PUTS THE FINGER" ON PRODUCTION COSTS**

INTERNATIONAL DRY BLENDERS are engineered to do the job and do it right—insuring Faster Blending Time, Uniformity of Product and Lower operating cost...If you are interested in increased production and in saving money thru greater blending and mixing efficiency, drop us a line for Catalog and further information.—No obligation of course!

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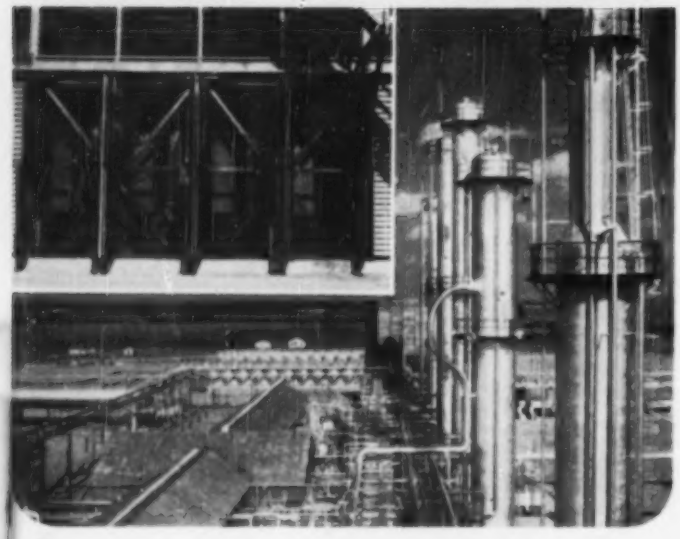
BALL MILLS, PORTABLE & PERMANENT MIXERS, BLENDERS, AGITATORS

DAYTON 1, OHIO

# WESTERN'S VERTICAL SECTIONS



*at Warren's Maysville...*

**Continuing a long and pleasant relationship with Warren Petroleum Corporation, Western was privileged to furnish a major portion of the bare tube atmospheric sections in the Maysville plant, as well as at the Antioch and Lindsay Stations.**

**Western vertical atmospheric exchangers are available in surfaces ranging from 300 sq. ft. to 2500 sq. ft.**

See Western's sections in the current issues of Refinery Catalog, Chemical Engineering Catalog, and Thomas Register.

San Francisco Representative: Trident Engineering Company

**WESTERN**
***HEAT EXCHANGERS***

*Manufactured by*
**WESTERN SUPPLY COMPANY**
P.O. BOX 1888 TULSA, OKLAHOMA
*SALES OFFICES — DALLAS — HOUSTON*




burned the redwood installation to the ground. The cooling tower, part of a new unit under construction at the plant, had never been used. Damage to pumps and other equipment brought the total fire loss to $300,000.

## Ohio Clean-Up Progressing Despite Water-Use Dispute

Disputes about water use must be settled before the anti-pollution program for the Ohio River Valley can be successful, it was reported recently by Joe L. Quinn, chairman of the Ohio River Valley Water Sanitation Commission. "While millions of people in this industrial empire of the Midwest need these streams for water supply and recreation," he said, "the fact cannot be ignored that these streams must also serve to carry away the wastes from communities and industries."

A year ago residents of the Ohio Valley region woke up to the fact that the river was a filthy mess. At a meeting in Cincinnati of governors and representatives of the eight states concerned, the commission was appointed to do something about the pollution.

The technical problems are not too great, Chairman Quinn pointed out, for rivers have miraculous powers for self-purification if they are not overloaded with sewage and industrial waste. The commission has held public hearings on the establishment of river quality standards, and notices have been sent to 1,000 industries and 1,100 towns telling them of the necessity for installing correctional facilities. As a result of this, several towns are designing treatment works.

Cincinnati has already launched a $25,000,000 treatment program, begun exactly one day after the eight state agreement. Sites have been purchased for the disposal works, arrangements have been made with 19 local communities to join in the construction, and by June 1949, more than $1,500,000 had been collected for the project by a surcharge on water service.

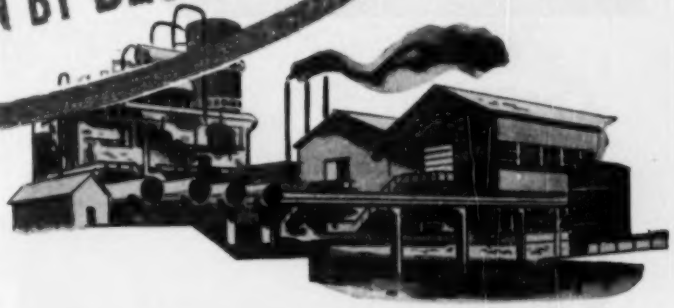
Estimated cost for the entire river cleanup is about $700,000,000. Mr. Quinn emphasized that such a job will take time to construct, even after the money is raised and the plans completed. Industry, he said, has been particularly helpful in doing its part in stream pollution abatement.

The commission is also studying pollution problems on the Wabash, principal tributary of the Ohio. Work is still in the initial stages but will serve to accelerate present corrective programs. The project was authorized

(Continued)

# *The Mark of a Modern Chemical Processing Plant...*

# INSTRUMENTATION BY BECKMAN!



**In both industry and science the name "Beckman" has become synonymous with leadership in a vital field of instrumentation—that of adapting complex scientific instruments to the quick and accurate solution of modern analytical and control problems. If you are not using these Beckman Instruments in your operations, you should investigate today the important savings they can make for you...**

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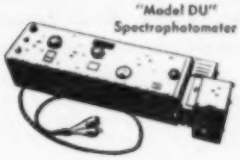
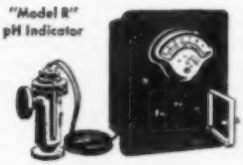


"Model B"
Spectrophotometer

"Model R"
pH Indicator



OTHER BECKMAN INSTRUMENTS include IR-2, IR-3 and Flame Spectrophotometers, Radioactivity Meters, Photopen Recorders, Flow Colorimeters, Ultrohmmeters and other advanced instruments. For the most modern in instrumentation, consult Beckman!

**THE BECKMAN QUARTZ SPECTROPHOTOMETER**

is ideal for industrial and research laboratories to facilitate the speed and accuracy of chemical analyses... of color-matching paints, textiles dyes, paper, etc.... of controlling quality and uniformity in the production of drugs and pharmaceuticals... of simplifying metallurgical analyses, hydrocarbon determinations and many other diversified applications. This versatile instrument covers the ultraviolet, visible and near-infrared spectral regions, and gives both % Transmission and Density readings on solid, liquid and gaseous samples. It is unusually simple to operate, incorporates many unique design features that insure sustained accuracy and dependability, and it can be used with a wide range of accessories to further increase its all-around utility.

**THE BECKMAN "MODEL B" SPECTROPHOTOMETER**

combines many unique spectrophotometric advancements in a low priced instrument that is particularly suited for routine analytical operations. This instrument has better ultraviolet performance, better resolution, better wavelength and photometric accuracy, and more freedom from stray light than any other instrument in its price field. It has many uses in industrial laboratories for simplifying analytical operations in chemical, metallurgical, pharmaceutical and hydrocarbon processes—as well as for quick, accurate color-matching applications in textiles, paints, paper and other similar fields where close color control is essential. It covers the visible region as well as portions of the ultraviolet and infrared spectrums and can be used on liquid, solid or gaseous samples. The "Model B" brings the speed, accuracy and versatility of modern spectrophotometric analytical methods into the price range of even the most modest laboratory—yet it incorporates vital features found in no other instrument in its field.

**BECKMAN GLASS ELECTRODE pH INSTRUMENTS**

are universally recognized as leaders in the industry. Not only does Beckman provide the widest variety of pH meters—portable, research, AC-operated and battery-operated, as well as completely automatic equipment for large-scale process control—*but Beckman also provides the industry's greatest variety of glass electrodes for use with its instruments.* Since the accuracy and utility of pH equipment is limited by the electrode systems available for use with it, Beckman's unequalled range of glass electrodes is of utmost importance.

Wherever there is water or water solutions —slurries, moist pastes or moisture-containing semi-solids such as cheeses, doughs, jellies, etc.—there is pH. If you have fluid processes or products *anywhere* in your operations, chances are you can save time, minimize waste, by Beckman-controlling the pH of your operations. *Write outlining your problems and our experienced engineers will be glad to assist you without obligation.*

**Our trained research staff will outline the important savings you can make by installing Beckman instruments on *your particular* operations. Write, wire or phone for further details. *Beckman Instruments, National Technical Laboratories, South Pasadena 14, California***

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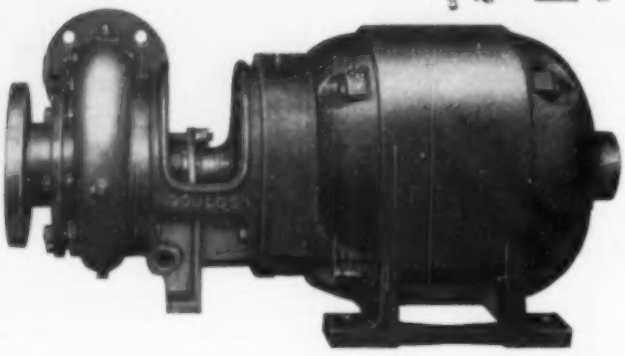

# Goulds "Close-Cupld"

This efficient, advanced design pump gives the operating man many advantages that eliminate liquid transfer problems.

The pump and motor are a compact unit. The single shaft maintains perfect alignment and the unit is vibration free. You don't need a bedplate.

All you do is set the "Close-Cupld" in place, connect it up and turn on the current.

*Sizes and Capacities:*

We make the "Close-Cupld" in 17 sizes with capacities up to 2000 G.P.M., heads up to 400 ft. depending on capacities.

Send for a free copy of Bulletin 701.1 today. It gives you complete data on Goulds "Close-Cupld" pumps.

MEMBER

Goulds PUMPS INC.
Seneca Falls
New York

News, cont. . .

at regular meeting of the commission. sion last month.

The commission, said Quinn, is not just a "survey and report-writing agency." It will get action; and it has adequate legal powers to back it up if it has to use them, he declared.

### Jefferson Comes to Terms With Striking Pipefitters

Dispute between the Jefferson Chemical Co. at Port Neches, Tex., and Pipefitters' Local 195 (AFL) has been settled by collective bargaining.

The strike had been called by the union in protest against the company's policy of paying part-time or temporary employees at the plant the prevailing wage scale for maintenance workers instead of the wage scale prevailing in the building craft.

This strike came almost immediately after a nine weeks' strike involving Jefferson and the CIO Oil Workers had been settled by agreement on a new contract.

### Cit-Con's Lube Plant Latest In Booming Louisiana Center

The new lube oil plant of Cit-Con Oil Corp. at Lake Charles, La., was formally dedicated December 8. This $42 million solvent-refined lubricating oil refinery is a joint enterprise of Cities Service Co. and Continental Oil Co. The furfural and the Duo-Sol solvent refining units are the largest of their type ever built.

Cit-Con's designed production capacity is 6,000 bbl. of lubricating oil base stocks daily, plus an annual output of 70,000,000 lb. of fully refined paraffin wax of the quality used by the food packaging industry.

The new Cit-Con plant is in a rapidly developing center of the oil refining industry. It is one mile from a Cities Service basic refinery and six miles from a Continental Oil refinery. Nearby are the Cities Service-operated, government-owned butadiene plant, and a Firestone synthetic rubber plant.

### Out of Cellulosics, Koppers Concentrates on Polystyrene

The Chemical Division of Koppers Co., Inc., is leaving the cellulosics field to devote all its plastic-manufacturing facilities to its rapidly expanding polystyrene business.

The Koppers division has compounded and colored cellulose acetate and ethyl cellulose at its Berkeley

(Continued)

# I CAN IMPROVE *PROCESSING* SYSTEMS IN 5* WAYS!

"I am De Laval Centrifugal Force. I make possible cleaner, faster separation of two liquids (with a removal of solid impurities) or quicker and more complete removal of solids from a single liquid.

"I speed up processes because I make them continuous. The liquids that I separate are discharged from the De Laval centrifugal machine in a steady stream, and the solids that are thrown out of the liquids are stored out of the zone of separation until the bowl needs cleaning.

"Many different types and sizes of De Laval centrifugals enable me to be used to best advantage. The large 'Nozzle-Matic' models enable separations to be made at capacities up to 6,000 gallons per hour; the small Laboratory model makes efficient pilot plant separation work possible. The type of machine required is dictated by the nature of the liquids being processed. Write for additional information."

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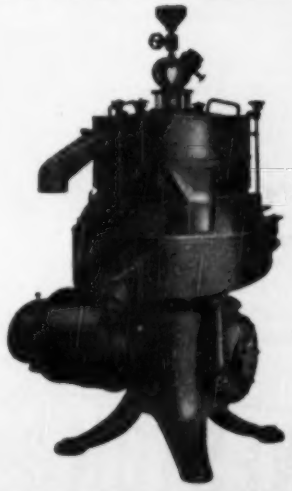
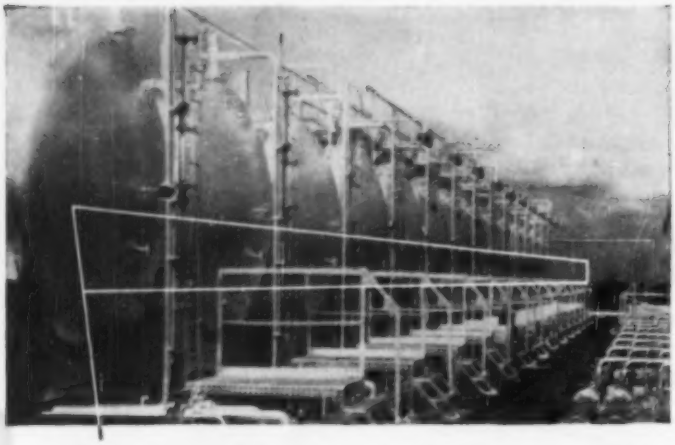
***Here They Are:**

**SPEED PRODUCTION**
**SAVE LABOR**
**REDUCE PROCESSING TIME**
**IMPROVE PRODUCT**
**SIMPLIFY WASTE DISPOSAL**



# DE LAVAL
## CENTRIFUGAL MACHINES
## FOR *PROCESSING* SYSTEMS



*Right down the line!*

*it's*

**WESTON**

*All-Metal Thermometers*

Wherever you need quick, accurate temperature readings—on tanks, processing equipment, bearings, pipe lines—specify WESTONS *right down the line.* Not only are their large, boldly marked dials easy to read, but their accurate dependability is assured by WESTON'S *all-metal* construction. They stay on the line longer—cost far less in the end. Available in types, stem lengths and ranges for most applications. Call your jobber or local WESTON representative, or write for Thermometer Bulletin. WESTON Electrical Instrument Corporation, 590 Frelinghuysen Avenue, Newark 5, N. J.

**CONTACT-MAKING models for alarm or control purposes. MAX-MIN models to indicate highest or lowest temperature reached.**

**WESTON** *Instruments*



Heights, N. J., plant for several years, and these facilities, as well as plastic-production facilities at its large Kobuta, Pa., plant, will now be devoted entirely to polystyrene production.

Parts of the Berkeley Heights plant that have been devoted to work with cellulosics will be converted to the compounding and coloring of polystyrene at once.

In the field of polystyrene plastics, Koppers has complete production facilities. Polystyrene is made at Kobuta in a Koppers-owned plant that produced styrene for the wartime synthetic rubber program. Compounding and coloring are also done at that plant.

## BRIEFS . . .

**American Vegetable Oil Association** is expected to start operations at its new 120,000-gal. anhydrous ammonia plant at Clarksdale, Miss., this month. The ammonia will be used as a fertilizer for the tung orchards in the area. The Association, formed by 23 tung-grower stockholders, awarded the contract to Gotcher Engineering & Manufacturing Co. of Clarksdale.

**Solvent extraction plant** for soybeans and other oil-bearing materials, just started at Belozoni, Miss., will cost $250,000. This 60-ton plant will be capable of processing 2,000 bu. of beans daily and will have a capacity for storage of 250,000 bu.

**Halliburton Portland Cement Co.'s** plant at Corpus Christi, Tex., is expected to start operations this month. Preliminary operations in the $10 million plant are already under way. Grinding of ore and shells started before the first of the year. These operations necessarily precede any cement production, since large quantities must be stored before full-scale operations can begin.

**Roach Paint Co.'s** new plant at Dallas, Tex., was completed December 15. The company began operations here in 1931. The new tile and brick building will house the factory, warehouse, offices, and retail and wholesale departments.

**Arkansas Farmers Plant Food Co.'s** fertilizer plant, located at North Little Rock, commenced operations November 22. The company is owned by local farmers.

**New fertilizer plant,** being built at Sylvania, Ga., by two brothers, J. A. and A. S. Mills, will have a production capacity of more than 400 tons of fertilizer a day. —*End*

ASK STOKES

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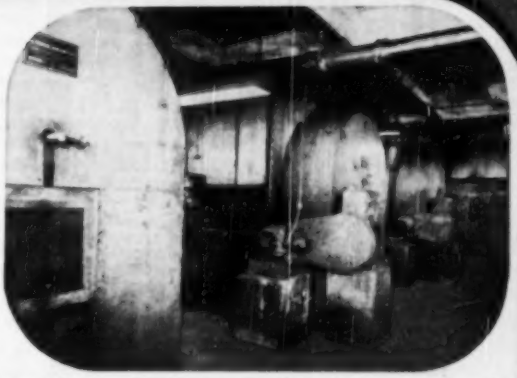

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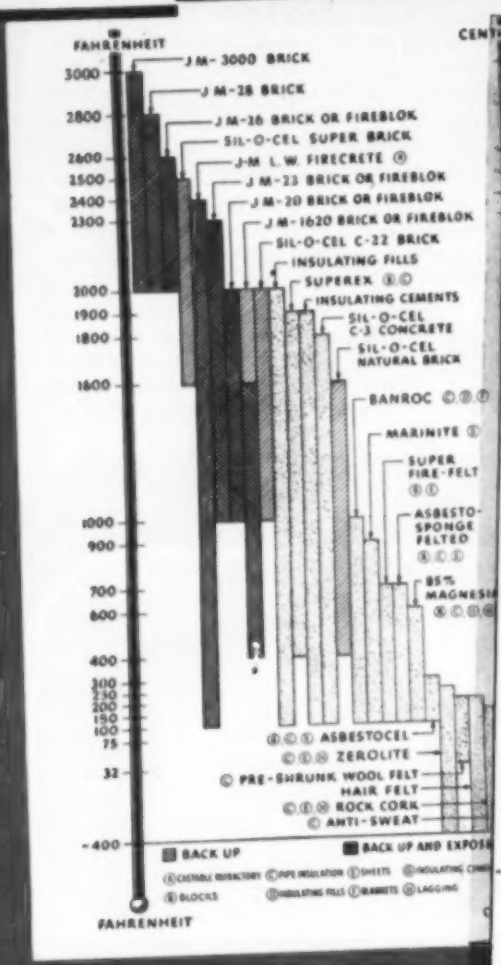


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# *Men, Machines and Methods*

ROGER WILLIAMS, Jr., *Associate Editor*

## How and Why to Hold Plant Openhouses, A Real Method of Improving Community Relations—Part I

NOTE: *The following is the first of a two-part article on the methods of conducting plant visits, one of the best ways to obtain community goodwill. It was prepared by the community relations division of the Du Pont public relations department as a manual for Du Pont plant managers.*

*In this first part, the reasons behind plant visits are discussed, as well as the general objectives, the types of visits possible, and the types of groups to have. Next month's concluding portion of the manual will cover the organization of visits, discussion techniques, and the legal implications of having visitors.*—EDITOR.

The increasing interest of the American people in business and industry offers great oportunities to improve plant community relations. Never before has this interest been as high, or its significance as great. Good public relations for any activity depend more than ever before on knowledge and understanding, and to achieve this end many efforts and techniques are being employed by industrial companies.

One of these is the program of plant visits, through which employees' families and other outside groups are encountered to tour the plant premises. The method is not new, but the times have brought a broader conception of the improved community relations which a well-considered program can create.

For years prior to World War II, industry was inclined to look with disfavor on the prospect of having outsiders visit operations areas, where they would ask prying questions, disrupt routine, and perhaps expose themselves to personal injury.

"Visitors Day," wherever held, was confined usually to plants manufacturing a consumer product, where the policy was inspired more by possible advertising benefits than other considerations. Even this practice was neither common nor regular. The traditional attitude of aloofness in many cases has fostered suspicion, given rise to rumors and distortions and contributed substantially to public misunderstanding of business and its motives. The unknown has always been regarded with distrust.

The war years stimulated plant visits by demonstrating the importance of public support. Competition for personnel, the necessity of dealing with public groups such as the draft boards, and dependence upon community good will opened the gates of many plants. Results were excellent and paid good dividends in improved public opinion, employee morale, and, in some cases, work performance of employees. At the present time, plants of numerous companies have continued visitation programs into the peacetime era. They have become accepted as one of the good methods of achieving sound relations on and off the plant.

Based on experience both in and out of the Du Pont company, this article proposes to review the broader implications of a good plant visit program, to discuss this technique as a means of strengthening community relations and employee morale, and to suggest practical ways of obtaining results of the most benefit to the plant and the company.

To date, over-all Du Pont experience has been scattered, ranging from no visits at all to formal schedules which arrange tours for various groups. All plants are somewhat different, even when the same product is being manufactured, so detailed methods of handling visitors must differ also. In some plants, visitations may be entirely impractical.

No suggestions made herewith should be construed as applying to all circumstances. They represent, however, an effort to consolidate the best thinking on the subject, to facilitate planning, and to emphasize the basic industrial philosophy which a good visitation policy should embrace.

### OBJECTIVES

A good plant visit program seeks to improve community relations and strengthen employee morale. To achieve this, certain fundamental objectives should be kept in mind:

1. *To establish the plant as an integral part of the community.* At many locations local citizens consider a plant as simply a mass of machinery contributing little, if anything, to the welfare of the community. The implications of absentee ownership are thus emphasized, and sometimes a plant loses by default the campaign for public opinion. Actually, most plants, no matter where the ownership lies, contribute substantially, economically and socially, to the surrounding area, and plant visits can show the importance of this factor.

2. *To show that, although a plant has special problems, it trys always to be a good community citizen.* The Opinion Research Corp. has found that for a plant or company to remain aloof is to lose the battle for public opinion by default. Being a good community citizen is not enough—people must be impressed with this fact. Reading about a plant's activities in the newspapers has its advantages, but it is even more impressive to allow people to see for themselves.

3. *To show by a "living example" the workings of the capitalistic system and free enterprise.* Plant problems of human relations differ only in scope from the problems of the company and business generally. Whatever can be done at the community level to solve these difficulties has a wholesome effect beyond the immediate benefits to a single plant or company. America has the highest standard of living in the world, which is only a result of the social, political and economic system this country has adopted. Yet there is much misunderstanding of industry's true role and contribution under this system. One of the most impressive ways of explaining how industry works is to let people come and see it in action.

4. *To emphasize that modern industry is attentive to the human factor.* Many people are still receptive to the charge that modern industry operates in sweatshop fashion, working its employees too hard and paying them too little. Even outsiders who are unwilling to believe this cannot be expected to know much about

(*Continued*)

(No. 9)

***Purity In Activated Carbon***

Unwashed carbons contain extractable substances that can contaminate the liquid being processed, and even impart color to a liquid which the carbon is supposed to free of colors. Because there is little sense, and less profit, in adding to a purification process anything that contains impurities, these undesirable constituents must be washed out before the carbon is ready for the user.

Thorough washing with acid, followed by water washing substantially to neutrality, removes the extractable substances. Activated carbons of various purity levels meet the requirements of a wide variety of processes. For example: carbons of the highest purity for fine chemicals, pharmaceuticals, and other valuable, sensitive products; carbons of effective, uniform purity for industrial chemicals, most food products, and many other processes; unwashed carbons for applications in which a premium for purity is not justified.

In our next column, we'll tell you something about another all-important specification of activated carbon: *filterability*.

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actual conditions of employment unless they can be seen. Particularly with families of employees is this objective important. The stimulus to employee morale which normally comes from the visit of a family has proven well worth the effort in practically all instances. Problems of personnel procurement also may be facilitated by developing this objective.

PROPER EMPHASIS

Despite the fact that visitors say they come to a plant to see the manufacturing process, the average guest is more interested in *people* than in *things*. As will be seen from the foregoing general objectives, each can, and should, be related in some way to people. The belief that visitors are interested in how the material is manufactured, rather than in the contribution made to social and economic advancement, is a misconception. Actually, technical details of process should be incidental, with emphasis on the broader aspects of industrial operation.

Interest in the manufacturing process is high, and there is no intent here to suggest that it should either be ignored or treated lightly. It should, however, be the hub around which discussion revolves. The visitor-interest, thus stimulated, creates the opportunity for easy, informal demonstration of subjects designed to develop the primary objectives, relating the comments to what is being shown.

Unless a plant visitation program aims for more than just showing off the manufacturing process, it is safe to say that the emphasis is going in the wrong direction, and more worthwhile benefits, as reflected in the basic objectives, are not likely to be obtained in most instances.

OBJECTIVES

When the visit is planned with the proper emphasis, the basic objectives can be accomplished through a variety of methods. As will be outlined in a later chapter, the job of doing this falls to the persons responsible for administering the program, the supervisor-in-charge, the guides and the escorts. The following list of topics is suggested for each of the objectives, as specified. The important thing here is for plant personnel working on the program to get the "feel" of the fundamental aims and to become familiar with appropriate subjects; naturally the talks given will vary with the character, age, etc., of the groups visiting.

1. *Identifying the plant more closely with the community.* (a) Number of jobs on the plant; the total payroll and its subsequent economic stimulus to the community. (b) The plant's purchase of supplies and raw materials from nearby areas (which sometimes creates a substantial market). (c) Plant personnel participation in community-wide endeavors; the civil and service clubs, the Sunday Schools, the school board, municipal offices, etc.

2. *Emphasizing the plant's desire to be a good community citizen.* (Being a "good community citizen" itself implies the type of community identity mentioned in the previous objective. Any discussion which promotes the one, therefore, would help promote the other. In this second objective, the plant seeks to develop a favorable public attitude toward specific situations.) (a) Beautification projects for the plant or nearby property. (b) Trade waste disposal program — atmospheric and stream. (c) Correction of traffic nuisances caused by plant. (d) Necessity for 24-hour schedules and Sunday work.

3. *Demonstrating the capitalistic system and free enterprise.* (a) The capitalistic system: how stockholders pool money to finance erection of a plant, hire labor, and purchase materials; how the extent of public acceptance (purchase) of the product determines wages, dividends, new plants; how investment required for modern industry has grown steadily. (Spell out cost of "tools" per worker. Nearly $14,000 in Du Pont.) (b) Using a machine as an example, show workings of technology; how research and increased efficiency makes new machines, reduces unit production costs, increases production, actually creates more jobs and makes wage raises possible, etc. (c) "Better Things For Better Living," showing how products seen on tour raise the standard of living. (d) Widespread stock ownership of any big company. (Frequently, as in Du Pont, there are more stockholders than employees; nearly everyone is a "capitalist" through direct holdings or through insurance policies, savings accounts or other means.)

4. *Modern industry is attentive to human factors.* (a) Industrial relations plans and policies. (b) Safety achievements — regulations, policies, etc. (c) Average wage roll pay rates; wage policy. (d) Working conditions: change houses, cafeteria, medical facilities, recreational facilities on and off plant, employee publications, etc.

VISITING GROUPS

Visiting groups may be divided into three classifications, or types:

1. *Families of employees.* Many managements feel that the greatest value in a visitation program lies in the

aspect of employee morale, particularly when the visitors are employees' families. Since some visiting policies are confined to this group, and since special techniques may sometimes be desirable for receiving this group, it is given a separate classification.

2. *Community groups.* This includes civic clubs, chambers of commerce, ministers, teachers, and nearly every other group which does not have a highly specialized interest in the plant and its process.

3. *Technical groups.* Visitors which fall distinctly into this category are comparatively rare. It should be largely confined to industrialists, engineering, chemical and other scientific societies, etc. It does not always include, for instance, a high school or college chemistry class. Although their interest is somewhat specialized, it should not be directed to the process only.

TYPES OF VISITS

There are two general types of plant visitation programs:

1. *Visitors' Day* — annual open house. One day is set aside each year for "open house." Special invitations are sent to employees' families and to particular "friends" of the plant, while the general public is invited through newspaper and radio publicity. Special arrangements may include a formal program, souvenirs, and special decorations of the plant propeity. Visitors are directed in large groups over a prescribed route.

2. *Sustained Schedule.* Visiting days are held at either regular or irregular intervals as a permanent policy. It is generally known throughout the community that the plant welcomes visits by reputable groups—families, technical or non-technical—and permission to tour the plant is granted on each specific request. Note, however, the distinction between regular and irregular visits: (a) *Individual:* Each visiting date is specifically set and otherwise handled only when the outside group makes its request to visit. (b) *Regular visiting days:* The plant publicizes the fact that certain days during the week or month will be "visiting days" and any reputable group may visit the plant on one of those days if arrangements are made well in advance.

The annual open house is not recommended for Du Pont plants, except possibly for very small plants (less than 50 people) in a small community, where all guests during the day would number less than 100 and each could be treated with friendliness and individual attention. Otherwise, the net benefits of such a single day's visitation appear hardly to justify its

(Continued)


COOPER ALLOY NEWSCAST

PUBLISHED BY THE COOPER ALLOY FOUNDRY CO., HILLSIDE, N. J.

**FORTY TONS OF WATER FOR EVERY TON OF COAL**

**PUMPING CONDITIONS IN ANTHRACITE MINING DEMAND THE BEST IN MATERIALS AND EQUIPMENT**

For every ton of anthracite coal mined, almost forty tons of water have to be removed. Since annual production approximates 45,000,000 tons of coal, the magnitude of the pumping problems connected with the removal of water by the billions of tons is staggering.

According to engineers at Barrett-Haentjens and Co., Hazleton, Pa., leading designers and manufacturers of centrifugal pumps, pumping conditions encountered in anthracite mining present a constant challenge to mine operators and equipment designers; for not only must the equipment be designed to resist corrosion, as in mine drainage work, but it must also be able to withstand the abrasion encountered in coal preparation.

Mine drainage pumping involves continuous operation in solutions where the pH ranges as low as 2.7-2.9. The volume handled ranges as high as 10,000 g.p.m. under pumping heads from 200 to 1200 feet. Corrosion means costly shut-down . . . and in times of "highwater," as may occur during a rainy spell, such a shut-down may be disastrous.

To eliminate this danger, engineers at Barrett-Haentjens recommend the use of Cooper Alloy 19A, a stainless steel alloy containing 28% Cr. and 3% Ni. Laboratory and field tests have demonstrated the excellent service to be obtained from the use of this alloy, and mine owners are becoming convinced that the higher initial cost is far outweighed by the long range economies effected.

The most severe pumping conditions, however, occur when this acidulous mine water is used in the coal cleaning or preparation process. In addition to the acid, pumps must handle coal, slate, rock and dirt, and in some systems, sand. Specially built Hazleton type "CB" solids handling pumps provide satisfactory service in this application, thanks to the excellence of the design and the wise use of Cooper Alloy 19A for impellers and wearing rings. Frequently, the entire pump, including the huge casing is cast in this corrosion and abrasion resistant alloy to assure guaranteed service.

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practice, particularly in view of the much greater benefits of the sustaining type program.

For smaller plants, the individual visiting day is usually considered adequate. The number of outside people interested in the plant is relatively small, and everyone may be included in only a few visits. Each occasion can be arranged casually and informally at the convenience of management. Frequently, however, not only is this type (unscheduled) most satisfactory for small plants, but larger plants, too, have found this method effective, particularly after the program has run for a time and most of the interested groups have visited.

The type wherein visits are held at regular intervals has proved desirable when larger plants are beginning the policy of visitations for the first time. There usually is a rush by outsiders to be among the first groups to visit, and it is necessary to set aside certain visiting days. In Du Pont plants, frequency ranges all the way from twice weekly to once monthly.

As a rule of thumb, any plant of much size contemplating visitation for the first time should consider starting with specified visiting days at regular intervals, shifting to the unscheduled routine as interest wanes. In either program, responsibility for administering it should be fixed and permanent.

HOW, WHEN AND WHOM

The invitation problem is keenest when plants are beginning a visitation program for the first time; otherwise, groups which have evidenced a principal interest already have visited. Certainly the matter should always be approached somewhat cautiously; small danger points do arise. When one group is invited, for instance, it is natural for speculation to arise in another group as to why it was not invited first. These points should be considered:

1. It is preferable for the invitation initiative to remain outside the plant, allowing visits only when groups request permission. This applies to all types of visitors, employees' families, community and technical groups. Visits may be encouraged without sending formal invitations.

2. It is considered unwise to direct the visitation program to one segment of the community to the exclusion of others. A good example of this would be inviting school teachers, while discouraging other outside groups to visit.

3. If the visits are being allowed for the first time, a brief announcement to that effect in the local newspaper usually will be sufficient. From

the word-of-mouth publicity which follows each visit, other groups will become interested. When the program becomes so popular that groups cannot be accommodated on a casual or informal basis, special days may be set aside at regular intervals.

4. As a policy, visits should be allowed in order of request—on a "first come, first served" basis.

5. Some plants have found it advisable to keep the visitation program confined to employees' families in the earlier stages, thus creating a "privilege" atmosphere. In any event, employees' families should be included in the program from the beginning.

6. There are times when special invitations are in order—usually when a particular problem exists which is susceptible to improvement by virtue of the visit. (An example would be false criticism that the plant is doing nothing to cure a waste disposal problem.) Such invitations are much more easily arranged if the visitation policy has been in effect for some time. In the absence of a previous program, the special invitation may well become open to suspicion.

*(To be continued in February)*

## Briefs . . .

**Noolicks?** "Proprietors of a noodle factory in the Bronx situated in the lee of a chemical factory found their plant producing garlic-flavored noodles whenever the neighboring chemical plant went in for production of a chemical equivalent of that savory bulb," according to the Industrial Bulletin, put out by the N. Y. State Dept. of Labor.

**Acidair.** The same bulletin informs us, "An acid atmosphere is a corrosive and irritant one. It damages metals, textiles and all manner of things with utter abandon."

**Free Enterprise.** If you want to see a good booklet to explain the workings of the free enterprise system to your employees, write General Comics, Inc., 205 East 42nd Street, New York 17, N. Y., for a copy of "We Hit the Jackpot." Done in comic-strip style, the booklet does an excellent job of putting the fundamental advantages of the U. S. A. economy into easy-to-read, simple language. The cost of the booklet is low (less than 5 c. each for quantity purchase) and over 600,000 have been distributed already. Among the CPI companies which have distributed it are Spencer, Koppers, Interchemical, Johnson & Johnson, Lee Rubber, Quaker Oats and Hancock Oil.

—End


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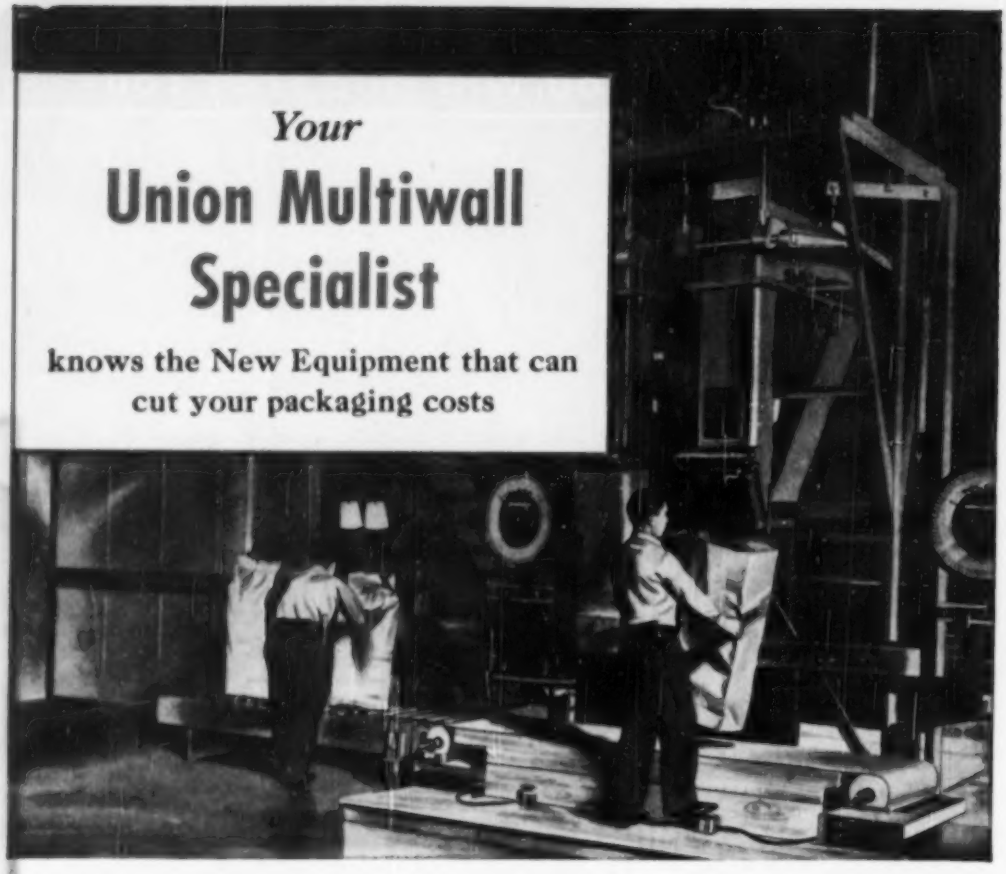

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# Handling, Packaging and Shipping

R. W. LAHEY, Editorial Consultant

TRUCKS AND BINS FOR RESINS IN PROCESS

TRUCKS AND BAGS FOR RESINS IN STORAGE

## Fork Trucks and Palletized Loads Speed Monsanto's Operations

The Plastics Division of Monsanto at Springfield, Mass., generally handles incoming, in-process and outgoing material on pallets with fork trucks. A fleet of 19 electric powered industrial trucks is required for this work. These trucks have load capacities of 2,000 to 6,000 lb. and are able to high tier pallet loads.

Use of battery-powered industrial trucks has speeded movement of raw materials and finished products, has reduced costs of warehousing, and has resulted in a decided reduction in man-hours required for materials handling.

Practically all raw materials and finished products which are packed in bags, bales, drums or cartons are palletized. One intermediate, a base resin, used in making Resinox, is stored in steel bins holding 3,500 lb. These bins are stored four high, all handling and tiering being accomplished with a 5,000 lb. capacity fork-lift truck.

Monsanto is experimenting with the use of disposable pallets both of wood and of paper.

## Five Major Developments In Packaging for Chemical Users

Manufacturing Chemists Association Technical Committees met in October at Atlantic City. Of the many subjects discussed at this series of meetings, the following are of importance in chemical packaging:

*Venting Plugs for Steel Drums*—A porous carbon disk incorporated in these plugs provides a means of venting. Devised specifically for use in steel drums for export shipments of sulphuric acid 66 deg. Be. they have possibilities for broad application in packaging liquids of high vapor pressure. Extensive shipments of sulphuric acid by several exporters packed in drums equipped with these plugs have arrived at destination in satisfactory condition.

*Steel Drum Linings*—For over a year the Battelle Memorial Institute have been engaged in an investigation of lined steel containers for the Steel Shipping Container Institute. This work has shown the necessity for pretreating the steel sheets. Means for improving application of linings have been developed and many lining compositions have been evaluated. It has been found that several new coatings such as a white polymerin, pure phenolic polyvinyl butyral compositions, vinyl chloride acetate and phenolic blends, as well as epon phenolics appear quite promising. This group has also undertaken the evaluation of exterior coatings of steel containers. In-

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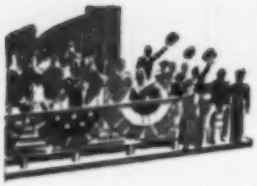

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dications are that pretreatment of steel is desirable for exterior as well as interior coatings.

*Construction of Light Gage Full Removable Head Drums*—As a result of a study undertaken by the Steel Shipping Container Institute and the Metal Packages Committee it has been found that certain construction changes may provide definite improvements in the strength of these containers. It is expected that final recommendations for changes will be forthcoming as soon as a final test has been completed.

*Standardization of Steel Containers*—The Bureau of Standards and the Steel Shipping Container Institute are embarking on a program to standardize dimensions and types of steel shipping containers. The API, the MCA, and other users of these packages will cooperate in this work.

*Rubber Drums for Hydrofluoric Acid*—Butyl lined rubber drums have been on test in hydrofluoric acid service for less than a year. Although a much longer test period is required to prove these containers, the results of test to date are promising.

## Bring Your ICC Regulations Up To Date

On September 21 the Interstate Commerce Commission issued amendments to their regulations. These changes became mandatory on December 20. Those revisions which are of interest to *Chemical Engineering* readers are summarized as follows:

**Sec. 61 Par. (b) (4)** HIGH EXPLOSIVES. Semi-gelatin types of high explosives may now be packed without spreading saw dust in the bottoms of the shipping boxes. Saw dust must still be used in boxes containing gelatin explosives and nongelatinous explosives containing 30 percent or more liquid explosive ingredient.

**Sec. 61 Pars. (c) (1) (c) and (c) (4) (c)** HIGH EXPLOSIVES (GELATIN DYNAMITE & BLASTING GELATIN) AND HIGH EXPLOSIVES CONTAINING NOT OVER 30 PERCENT LIQUID EXPLOSIVE INGREDIENT. Size of individual cartridges have been increased from a maximum of 10 in. dia. by 30 in. long to 12 in. dia. by 36 in. long. The maximum weight of 50 lb. per cartridge remains unchanged.

**Sec. 62 Par. (j) (2)** LEAD AZIDE. Shipment by common carriers of lead azide wet is now limited to the dextrinated type only.

**Sec. 193** INFLAMMABLE LIQUIDS WHICH ARE ALSO CORROSIVE LIQUIDS OR OXIDIZING MATERIALS are no longer exempt from the provisions of the regulations in any quantity or any type of packing.

**Sec. 110A** LITHIUM ALUMINUM HYDRIDE, ETHEREAL. In addition to previously authorized packing, this compound may be shipped in Spec. 15A wooden boxes with inside glass or earthenware containers of not over 1 qt. capacity enclosed in air-tight metal cans and cushioned with enough incombustible cushioning material to absorb contents. It may also be packed in specification cylinders as prescribed for any compressed gas except acetylene. Valves and fittings must be protected by a cap or equally efficient device.

**Sec. 152 (b) (c) (d)** NITRATES may be shipped in bulk or in bags in clean closed cars which shall be free of loose boards, cracks, holes, or exposed decayed spots. Interior of cars must be swept clean and free of any projections capable of injuring bags. Doors of cars must have tight closures. Journals and boxes must be in good condition. Ammonium nitrate, ammonium nitrate fertilizer, or guanidine nitrate must not be shipped in all metal cars.

In bags in closed or open-type motor vehicles which must be swept clean and free of any projections capable of injuring bags. Ammonium nitrate, ammonium nitrate fertilizer, or guanidine nitrate must be shipped in all metal motor vehicles of the closed type. Nitrates, including ammonium nitrate, ammonium nitrate fertilizer, or guanidine nitrate when transported in open type motor vehicles shall be suitably covered.

In bulk or in bags on freight vessels subject to the Regulations for Explosives or Other Dangerous Articles on Board Vessels prescribed by the Commandant United State Coast Guard.

In containers as prescribed in sec. 153. Note.—Nitrates of soda in bulk (not in containers) in cars, and in bags may be shipped in the same car.

**Sec. 247 (j)** ACETYLCHLORIDE, BENZOYCHLORIDE, PYROSULPHURYL CHLORIDE AND THIONYL CHLORIDE when packed in Spec. 5K nickel drums are now authorized for shipment. Formerly, benzyl chloride was the only Chloride that could be shipped in nickel drums. When shipped unstabilized the chloride must be anhydrous and be free from impurities such as iron.

**Sec. 247 (l)** BENZYL CHLORIDE may also be transported in Spec. 60 portable tanks but must be stabilized if loaded in unlined tanks.

**Sec. 248 (g)** ACID SLUDGE, SLUDGE ACID, SPENT SULPHURIC ACID, AND SPENT MIXED ACID may be shipped in Spec. 60 portable tanks in adition to previously authorized containers.

**Sec. 249** ALKALINE CORROSIVE LIQUIDS. The following additional packing has been authorized for transportation by rail freight, highway, and water: Inside containers of not more than 8-fluid oz. capacity each, resistant to lading, packed in strong outside containers, and cushioned with absorbent material in sufficient quantity to completely absorb liquid contents in the event of breakage, are exempt from specification packaging, marking, and labeling requirements for transportation by rail freight, or highway. When for transportation by carrier by water they are exempt from specification packaging, marking other than name of contents, and labeling requirements.

Spec. 60. Portable tanks, marked "For Caustic Soda, Liquid, Only," or "For Caustic Potash, Liquid, Only."

The following containers have been authorized for packing these compounds for express shipments:

Spec. 12B. Fiberboard boxes with inside containers of polyethylene, or other material resistant to lading, capacity not over 16 ounces each, adequately cushioned against breakage.

Inside containers of not more than 8-fluid oz. capacity each, resistant to lading, packed in strong outside containers, and cushioned with absorbent material in sufficient quantity to completely absorb liquid contents in the event of breakage, are exempt from specification packaging, marking, and labeling requirements, for transportation by rail express.

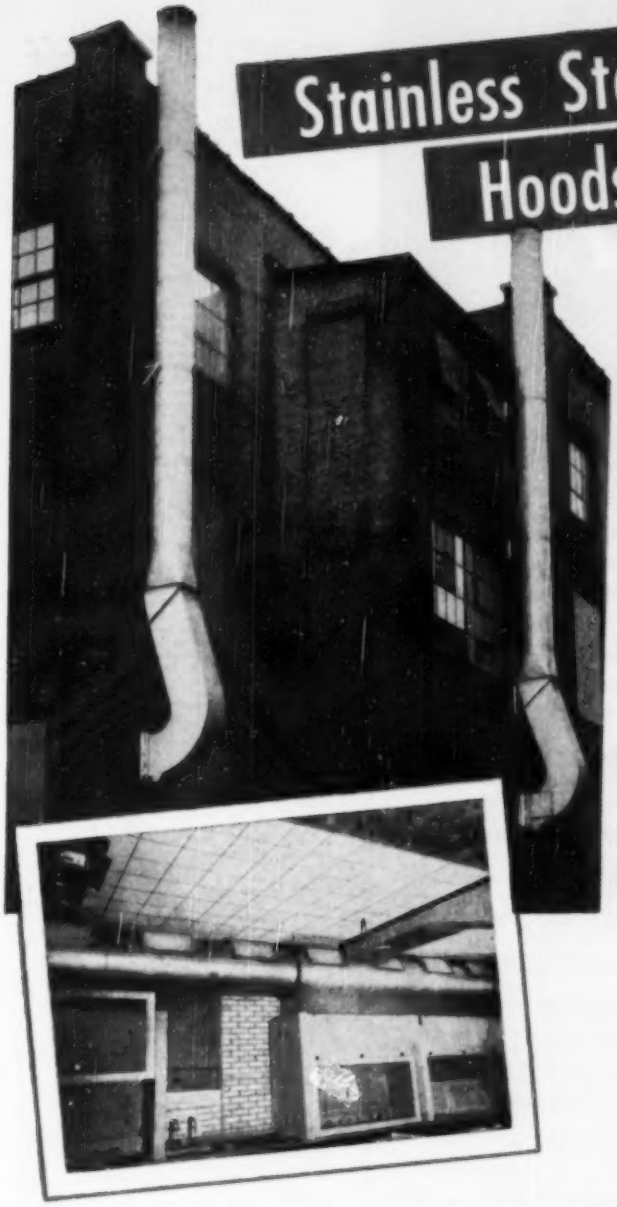
**Sec. 232C (1), (b) (1)** BROMINE PENTAFLUORIDE has been classed as a corrosive liquid and must be packed as follows for transportation by rail freight, highway or water:

Spec. 3E1800 or 4B240. Cylinders not over 120 lb. water capacity (nominal), filled to not over 210 percent of water capacity. Cylinders must be plugged and fitted with valve protection caps. Spec. 3E1800 cylinders must be packed in strong outside wooden boxes and contain not more than one pound of bromine pentafluoride.

When offered for movement by express the same Specification cylinders are authorized but not more than one pound may be packed in a cylinder. Cylinders

(*Continued*)

# Stainless Steel Hoods and Ducts



## resist the attack of concentrated acid fumes

In chemical plants, few structures undergo more severe corrosive attacks than hoods and ductwork. They are continuously exposed to highly concentrated acid fumes, which, combined with moisture and air, are often more corrosive than solutions of these materials themselves.

Fume ducts and hoods fabricated from U·S·S Stainless Steel give highly satisfactory service even when handling the concentrated fumes of hydrochloric, sulphuric, nitric, perchloric and other acids.

Superior resistance to corrosion, greater ease of cleaning, adequate structural strength with minimum weight, freedom from danger of product contamination, and high resistance to extreme temperatures . . . all these features of U·S·S Stainless Steel make it particularly suited for many types of chemical processing equipment.

U·S·S Stainless is offered in a wide variety of grades, finishes, sizes and shapes to meet every condition of use and fabrication. For the finest performance from your Stainless equipment, specify U·S·S Stainless Steel—a perfected, service-tested Stainless that is uniform in finish, composition and fabricating quality.

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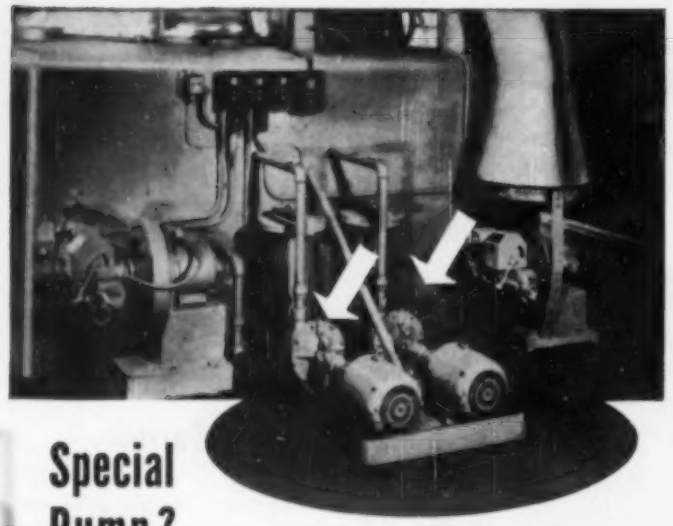

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| 4010A | Single Stage, Side Suction, Single Ball Bearing Centrifugal Pumps with separate liquid end construction. Sizes 1" to 10" discharge. Capacities: 10 to 3600 gallons per minute. |
| 4012A | Single Stage, Side Suction, Two Ball Bearing Centrifugal Pumps with separate liquid end construction. Sizes 1" to 10" discharge. Capacities: 10 to 3600 gallons per minute. |
| 4013A | Single Stage, Side Suction, Two Ball Bearing Centrifugal Pumps. Sizes 1" to 6" discharge. Capacities: 10 to 1200 gallons per minute. |
| 4303 | "Motor-Mount" Centrifugal Pumps, 63 standard sizes. Capacities from 5 to 650 gallons per minute. |
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**Deming Pumps**


PACKAGING, cont. . .

must be plugged and fitted with valve protection caps and must be packed in wooden boxes.

**SEC. 268 NITRIC ACID.** As this section has been completely revised the amended regulation is quoted below:

(a) Nitric acid in any quantity must not be packed with any other article.

(b) Nitric acid in any concentration which does not contain significant quantities of sulphuric acid or hydrochloric acid as impurities, when offered for transportation by carriers by rail freight, highway, or water must be packed in specification containers as follows: (1) Spec. 103C, Tank Cars. (2) The use of special aluminum alloy tank cars for test service is also provided for by ICC authority in docket 3666 dated Nov. 14, 1939, June 7, 1940, and Aug. 19, 1941, for the shipment of 95 percent or greater nitric acid. (3) Spec. MC310, Tank motor vehicles. (4) Spec. 5C, Metal barrels or drums. Authorized for concentrations of nitric acid as limited by paragraph (3) (b) of Spec. 5C. Containers weighing less than 95 percent of their original marked weight are not authorized. Spec. 5C drums already in service for transportation of this material, manufactured prior to Oct. 1, 1949, may be continued in service within the above limitations until further order of the commission.

(c) Nitric acid of 80 percent or greater concentration which does not contain significant quantities of sulphuric acid or hydrochloric acid as impurities, when offered for transportation by carriers by rail freight, highway, or water it must be packed in specification containers as follows: (1) Spec. 42B or 5X; also 42, if made and marked prior to October 1, 1930. Aluminum drums, or aluminum-lined steel drums.

(d) Nitric acid of 90 percent or greater concentration, when offered for transportation by carriers by rail freight, highway, or water must be packed in specification containers as follows: (1) Spec. 15A, 15B, 15C, 16A, 19A, 11A, or 11B. Wooden boxes, barrels and kegs with inside containers which must be glass bottles not over 5 pints capacity each, individually inclosed in tightly closed metal cans and cushioned therein with sufficient incombustible mineral material. (see paragraphs (g) and (h)).

(e) Nitric acid of concentration of less than 90 percent, when offered for transportation by rail freight, highway, or water it must be packed in specification containers as follows: (1) Spec. 15A, 15B, 15C, 16A, 19A, 11A, or 11B. Wooden boxes, barrels and kegs with inside containers which must be glass bottles not over 5 pints capacity each. (see paragraphs (g) and (h)).

(f) Nitric acid of concentration of 72 percent or less, when offered for transportation by rail freight, highway, or water it must be packed in specification containers as follows: (1) Spec. 1A or 1C. Straight sided carboys in boxes or kegs. (2) Spec. 1X. Boxed carboys of 5 to 6 gallon capacity: single-trip for export only. For shipment by common carriers by water to noncontiguous territories or possessions of the United States and foreign countries: shipments from inland points in the United States which are consigned to such destinations are authorized to be transported to ship side by rail freight in carload lots only and by motor vehicle in truckload lots only. (3) Spec. 1D. Boxed glass carboys of not over 6.5 gal. nominal capacity. Means shall be provided so that accumulated pressure in bottle shall not exceed 10 psig. at 130°F., or shall vent at a pressure not to exceed 10 psig. (4) Cushioning for carboys must be incombustible mineral material, elastic wood strips, natural cork blocks or rubber blocks. Other materials may be used if approved by the Bureau of Explosives. The use of hay, excelsior, loose ground cork, or similar materials, whether treated or untreated, is prohibited.

(g) Closures for bottles. Glass stoppers ground to fit and held in place by plaster of Paris covered by a strong cloth securely tied: (1) Or, threaded-type acid-resistant caps with gasket or lining impervious to the acid and sufficiently resilient, or cushioned, to give an acid-proof closure; at least 1 complete continuous thread is required to be engaged when bottle is closed for shipment.

(h) Cushioning inside containers. Inside containers must be well cushioned. All material for cushioning must be incombustible mineral material, such as whiting,

(*Continued*)

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PACKAGING, cont. . .

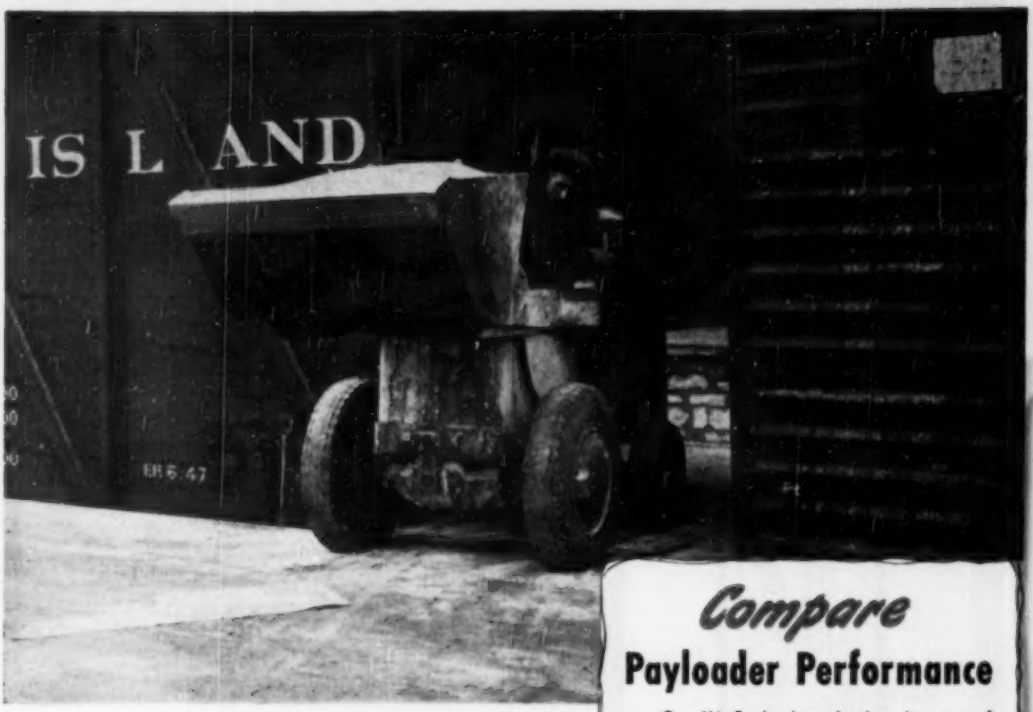
mineral wool, infusorial earth, asbestos, sifted ashes, etc. The use of hay, excelsior, ground cork, or similar material, whether treated or untreated, is prohibited. Where the cushioning material is very fine or powdery, separate partitions for the individual inside containers shall be provided to prevent the bottles from shifting and coming into contact with each other, and the box must be tight to prevent sifting of cushioning material. (1) Cushioning of inside containers in outside specification wooden boxes by means of elastic packings, such as wooden strips or large corks fastened securely prescribed for boxed carboys, in spec. 1A. (i) Nitric acid of any concentration, when offered for transportation by rail express, must be packed in specification containers as follows (also authorized for transportation by carriers by rail freight, highway, or water): (1) Spec. 15A, 15B, 15C, 16A, or 19A. Wooden boxes with inside glass bottles with glass stoppers ground to fit, and these stoppers must be held in place by plaster of paris covered by strong cloth securely tied. Glass bottles having necks with molded screw threads, must be closed by threaded type acid-resistant plastic caps. Caps must be equipped with an elastic composition cushion and with glass porcelain or similar liner which must be impervious to the acid. Such caps, when secured in place by at least one complete continuous thread, must be capable of preventing any leakage of the acid. (2) Or glass bottles having necks with molded screw threads must be closed by thread-type acid-resistant caps. Caps must be lined with a resilient liner which must be impervious to the acid. Such caps, when secured in place by at least one complete continuous thread, must be capable of preventing any leakage of the acid. (3) Each bottle must be placed in a tightly closed metal container, and well cushioned therein on all sides with incombustible mineral packing material, such as whiting, mineral wool, infusorial earth (kieselguhr), asbestos, sifted ashes, or powdered china clay. The metal container must be packed in outside containers, and well cushioned by incombustible mineral packing material as herein described. (4) Not more than 5 pints of nitric acid shall be shipped in one outside package.

The ICC order should be consulted for complete details of these amendments.

## Bundles of Sacks Can Save Pallets

St. Regis Unit Load—the systematic arrangement of multiwall paper bags in large bundles to accommodate lift truck movement—eliminates conventional pallets. The units stack neatly, facilitate quick inventory. Expendable slots accommodate standard lift truck forks. Each unit load contains approximately 1,200 multiwall sacks. —*End*

# How do you handle BULK Materials?

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The accompanying performance notes are only a few examples of how and why hundreds of plants are saving time and costs and boosting output per manhour with Payloaders. It will pay you to get the full Payloader story, too. The Frank G. Hough Co., 754 Sunnyside Avenue, Libertyville, Illinois.

## Compare Payloader Performance

- One HA Payloader unloads a box car of superphosphate in 2½ hours, traveling 200 ft. round trip to the stockpile. Formerly took 5 men, 4 hours. Also saves 40 manhours per car unloading bagged ammonium nitrate.
- Two HA Payloaders unload a 50-ton box car of chemicals in 1½ hours. Formerly took 9 men, 4½ hours.
- Unloading box cars of chemicals, also hauling fertilizer 150 feet to mixer, one Model HA Payloader and operator does in one hour as much as 15 men working 5 hours.
- Model HA Payloader unloads box cars of phosphoric acid. Compared to previous method, it has cut unloading time in half and saves 88 manhours of labor per car.
- Traveling 200 feet round trip, carrying loose fertilizer from bins and dumping into bagging mills, four HA Payloaders handle 50 tons per hour—save 126 manhours per day.

HOUGH
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# HOW TO HARNESS A VAC

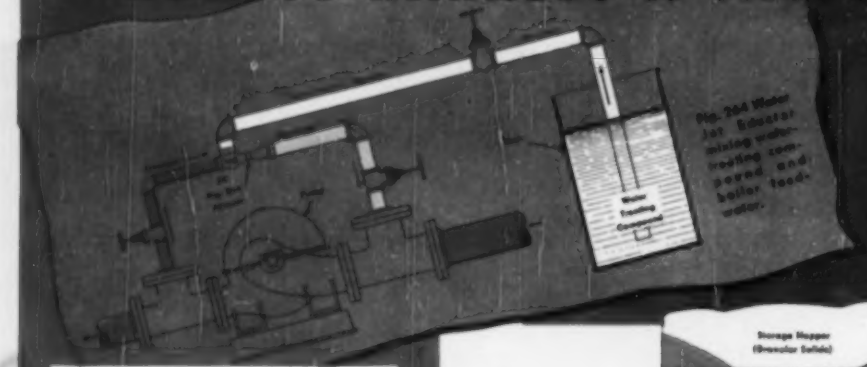
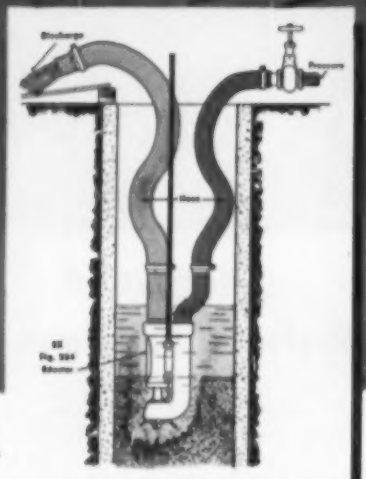
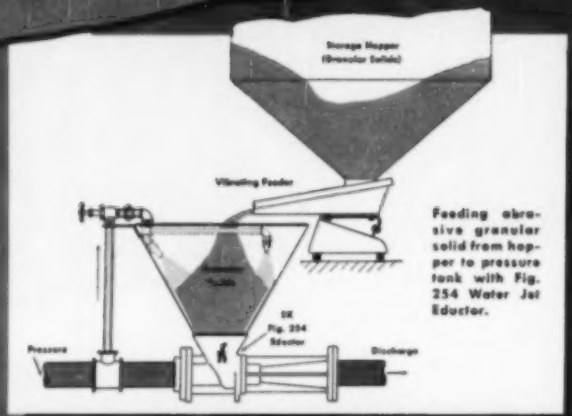


Fig. 264 Water Jet Eductor mixing water-treating compound and boiler feedwater.



Clearing sludge out of tank with portable Fig. 224 Mud Eductor.



Feeding abrasive granular solid from hopper to pressure tank with Fig. 254 Water Jet Eductor.

New Bulletin 2-M describes all types of Water Jet Eductors, with specifications and applications. Write today for your copy.

WE'VE been doing just that for years, with SK Water Jet Eductors. A versatile pump and mixer for all types of fluids, the SK Water Jet Eductor derives its power from partial vacuum. Vacuum, formed in the suction chamber of the Eductor, is created by the action of the pressure liquid.

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SK *engineering* can tailor a standard or special Water Jet Eductor to your problem. Mixing, blending and pumping of liquids, gases, slurries or solids—creating vacuum or pressure—are all within our scope. And SK *manufacturing* can provide a Water Jet Eductor in the size and material you require.

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# News From Abroad

*SPECIAL CORRESPONDENCE*

## Cutback in Dismantling Aids West German Chemicals

Frankfurt — Dismantling revision leaves guts of steel industry intact, and strengthens the chemical industry. Valuable byproducts are obtained by the restricted operation of synthetic oil and rubber plants. Seven steel plants are saved. This leaves a capacity of over 14 million tons and insures a balanced range of steel products. The foreign ministers dodged any upward revision to facilitate agreement among themselves, but the matter is not yet a practical issue anyway. Production rate in October was 8,300,000 tons. The steel industry has been unable to reach the level because domestic demand is suffering from a shortage of investment capital. But prospects are brightening with an upswing of domestic capital formation and likelihood of early admission of foreign capital. Also a sizable release of ERP counterpart funds is expected soon for German industry. Thus the Allies may have about a year before it's necessary to face the steel level issue.

Adenhauer's pledge, enactment of decartelization legislation, provides a political issue with significant implications. The fact that six of seven steel plants saved belonged to the old Vereinigte Stahlwerke combine, Germany's biggest steel cartel, underscores the importance of this issue. Whether Adenhauer gets conclusively branded as protector of German big business may hinge on the outcome of this legislation. The Allies are already reorganizing Ruhr coal and steel and will accomplish their aims. However, really effective reform of German ownership pattern depends on whether the Germans themselves sincerely subscribe to our concept of free competitive enterprise and prove their ability to police industry to this end.

## Aussies Working on Higher Potash Fertilizer Yields

Melbourne — The State Alunite Works of Western Australia, Australia's largest potassium fertilizer plant, is testing several process modifications which promise to give a better potassium yield and to enable the recovery of sodium sulphate and potassium chloride in addition to potassium sulphate.

The plant is located at Lake Campion (Lake Chandler), 32 mi. north of Merredin. The bed of the lake consists of a finely divided mud composed mainly of particles of alunite. Depth of the sediment ranges from a few feet to over 20 ft., over an area of 426 acres. Reserves are estimated at 12,000,000 tons of alunitic mud with an average content of 60 percent alunite and 21 percent silica. The quantities of recoverable potassium sulpnate and of alumina are estimated at 1,500,000 and 2,000,000 tons respectively. The air-dried mud contains 13.5 percent potassium sulphate.

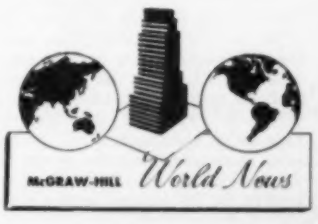
The plant is operating at an output rate of 100 tons per week in terms of a crude fertilizer containing 30 percent $K_2O$. The present expansion program envisages a daily production of 40 tons of fertilizer containing 50 percent $K_2O$.

Apart from the Lake Campion project, only small amounts of potassium fertilizer are produced in Australia by precipitation of the flue dust from the kilns of some cement works.

By the original process the crushed air-dried mud is heated in a rotary kiln to 700 deg. C. to 800 deg. C. so as to render the potash soluble in the raw material. The calcined fragments after cooling and reheating are then passed on to a continuous leaching plant. It has now been established that a more economic yield of potassium sales can be obtained by roasting a finely powdered mixture of the material with common salt to about 600 deg. C. and quenching the roasted charge with water, brine or, preferably, magnesium chloride solution.

The leaching plant is so designed that the calcined or roasted material is fed into the top of the outer section of a tank while hot water liquors are introduced at the bottom and rise through the descending bed of material, thereby dissolving the potash. The tank contains an inner cylinder into which the material is forced from the bottom of the outer section and discharged at the top by a vertical screw mechanism. Ordinarily only crude sulphate of potassium is obtained by fractional crystallization of the liquor, followed by centrifuging. However, by adding salt to the effluent and increasing the temperature to near boiling point, anhydrous sodium sulphate can be made to crystallize out. The solution separated from the anhydrous sodium sulphate is evaporated and the mixed salts thus obtained are subjected to an ingenious flotation treatment, yielding a practically pure potassium chloride, mixed salt and glaserite.

The problem of separating the sulphates of sodium and potassium has been solved by forming a saturated solution (with respect to K) at about boiling point. Common salt is then added to the solution until it is saturated with respect to NaCl. The potassium chloride is crystallized out by cooling the solution in two stages, ultimately to 5 deg. C.




## Mexico Comes Back into World Oil Picture

Mexico City—The group of U. S. oilmen, headed by Edwin G. Pauley of California, who signed a somewhat hazardous contract to explore for oil in Mexico on a percentage basis have been fortunate enough to strike a new rich field on their first try.

Nobody is guessing yet how much the new field will add to Mexico's estimated reserves (of some 10 billion barrels), but first tests of the new well, located south of Vera Cruz on the Gulf, show a flow of 1,170 bbl. per day. Another possible field is now being explored in the Yucatan peninsula tidelands.

While this will assure a payoff of some sort for the Pauley group (operating under the name of Independent Mexican American Oil Co.), it also marks another stride back for Mexico to regain its place among world oil producers (Mexico was once second in the world as an oil producer). Since

(*Continued*)

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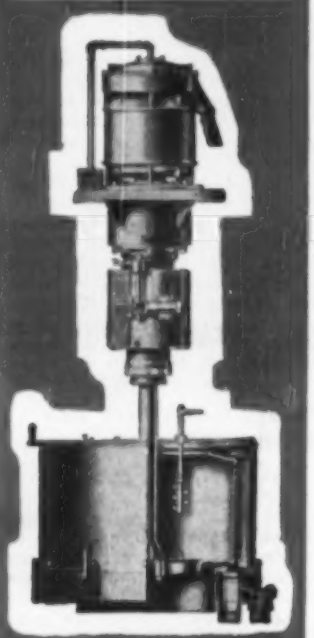

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the Cardenas administration expropriated foreign oil wells in 1938, little was done until Senator Antonio Bermudez took over the Mexican oil monopoly in 1946.

New Mexico has completed its first gasoline plant outside Mexico City and has two others under construction. One will cost $12 million dollars. It is being built by the Arthur McKee company at Salamanca, and expects to have its first new major pipeline from the Poza Rica field completed next spring.

The McKee company, of Cleveland, also built the $20 million dollar plant outside of Mexico City (known as the 18th of March refinery) which can handle 50,000 bbl. of crude per day including production of 2,000 bbl. per day of aviation gasoline.

The Salamanca plant, to be finished next year, will handle 30,000 bbl. of crude per day of which a large part will be diesel oil for Mexico's newly acquired diesel locomotives for its railroads.

A third refinery at Reynosa, in northern Mexico, was to begin construction last month.

The fact that these are the first new refineries that Mexico has built since the time of the expropriation is one indication of how badly the Mexican oil industry had slipped in the years in between.

Now, however, since the advent of Bermudez, Pemex has not only begun to modernize its facilities, but has increased production to a point where it now stands some 40 percent above 1937—the last full year of operation of the foreign companies.

Pemex itself has drilled over 80 wells during the past year and has brought in enough proved reserves to take care of production needs for the next three or four years.

These new fields include the Reynosa and Francisco Cano geological structures in northwestern Mexico, and a new field in the Moratillo region near Tampico which will have a daily production of 25,000 bbl. by the year's end. In the Isthmus of Tehuantepec in southern Mexico, two other fields have been brought in. Known reserves are now said to amount to 1,260 million barrels, while estimated reserves run to ten times that figure.

All of this is very important to Mexico, as it will provide a lever on which the entire industrialization program can be raised. Last year alone, Mexico was able to sell $40 million worth of petroleum products and that is only a start. But it is considerably better than two years ago when she could not meet her own gasoline needs.

## Bigger British Chemical Capacities Mean Stiffer Competition For Our Export Markets in 1950

London—British chemical manufacturers are looking back on 1949 as a year of solid achievements, but it has not been free of disappointments. Exports of chemicals, drugs, dyes and paints tended to decline until fall—from £7,510,000 a month in the first quarter of 1949 to £7,340,000 in the second quarter and £6,670,000 in the third quarter. An improvement in export enquiries and orders occurred after the devaluation, but volume of shipments in the fourth quarter still fell far below the end-1949 target of £9,000,000 a month set by the Board of Trade. As a result of reduced overseas shipments and a change in buying habits of domestic customers, most sectors of the chemical market were easy and supplies were ample.

As the year ended, a fair amount of new contract business was placed for 1950, but more consumers are meeting their requirements by spot transactions, leaving the risk of business fluctuations to the producer. As a result, many chemical manufacturers have had to carry larger stock. In some cases inventories have also grown because of temporary saturation of the market. In the coal tar section many products are disposed of regularly and easily, but stocks of others have accumulated despite price concessions.

Inorganic chemicals production is up to requirements. In the plastics industry, the saturation point was reached in 1948. In the pharmaceutical trade the introduction of a National Health Service resulted in increased demands, but by the end of 1949 all requirements, including those of the most modern drugs, were met out of current production. Great progress was made in the dyestuffs field, while the paint trade, though benefiting from improved supplies of drying oils, suffered a slight setback owing to the cut of the housing program and completion of postwar repair work. According to official indexes, a chemical production during most of 1949 was only slightly above the output level of 1948. These indexes may be misleading, but there is no reason to assume that the chemical industry fared better than British industry as a whole, apart from certain specialized sectors.

The changes of the past year are well illustrated by the sulphuric acid

(*Continued*)

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F-14A

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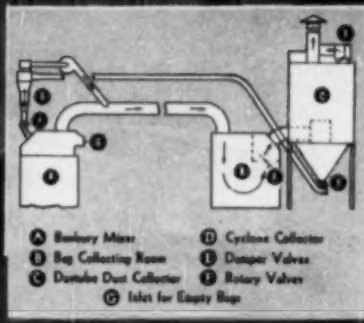


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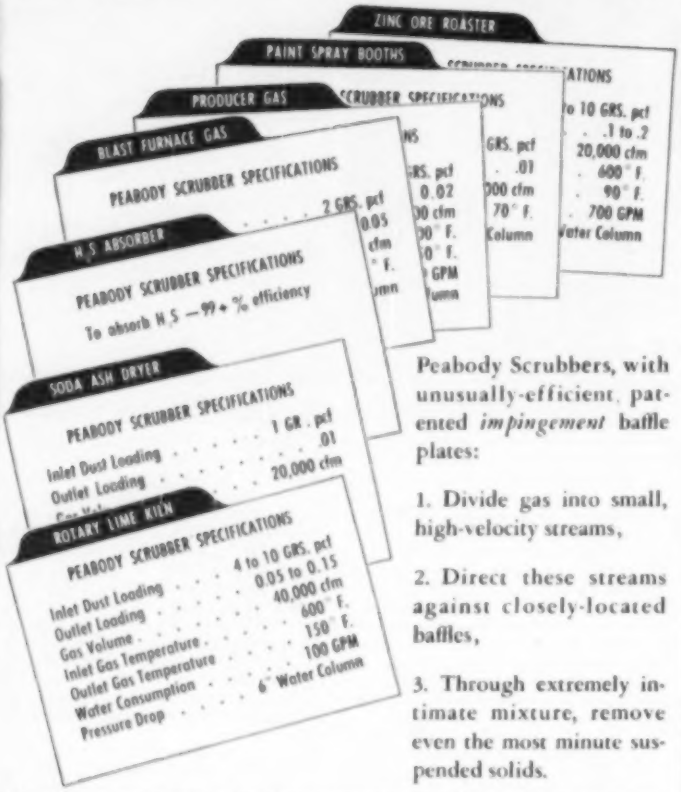
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FOREIGN NEWS, cont. . .

industry. During 1948 British sulphuric acid factories worked at an average rate of 91.5 percent of capacity, and the contact plants alone at 95.9 percent. The industry thus made full use of all available plant and produced a total of 1,601,438 long tons. In the third quarter of 1949 sulphuric acid production amounted to 402,926 tons and was thus almost exactly at the 1948 rate, but the rate of plant utilization was down to 89.0 percent—93.8 percent for contact plant alone—as additional capacity had been installed. For the same reason production in chamber process plant was down from 762,038 tons in the whole of 1948 to 165,193 tons in July-September, 1949, for as more new contact plant came into operation, it was possible to do without some of the more obsolete chamber process works. The trend revealed by the sulphuric acid statistics also holds good for other important chemicals.

Nevertheless, most British manufacturers continue to invest large sums in new plant, even though it is anticipated that consumption will not keep in line with the growing output capacity for many products. Their chief reason is that the British chemical industry has, certainly since the war, been operating with too small plant reserves and that in the interest of operational efficiency no less than in order to meet sudden spurts in demand additional capacity is needed, to say nothing of the fact that with manpower remaining a bottleneck in expansion plans in many localities and with growing competition demanding economical plant operation, highly mechanized modern plant is needed to keep the industry in a competitive condition. Expansion projects are therefore pursued with vigor in the sulphuric acid, chlorine, soda and tar distillation industries.

REFINERIES GROW

The most striking developments during 1949 took place in the petroleum field. The British oil refining capacity is to be increased by 14,000,000 tons by 1952-53, and a beginning has been made on site clearance and construction work by the Anglo-American Oil Co. (Standard Oil of New Jersey) at Fawley near Southampton where soon Europe's largest oil refinery will be situated. The Shell group has pushed ahead work on the two new refineries at Stanlow, on the Manchester Ship Canal, and Shell Haven in Essex, the former of which will be in partial operation in 1950. The Anglo-Iranian Oil Co. is extending its refinery at Grangemouth in Scotland and is to expand considerably

the refinery at Llandarcy, South Wales. Other refinery construction and extension projects are being formulated by the Trent Oil and Manchester Oil Refinery companies. The increased tonnages of petroleum derivatives and byproducts which will become available over the next few years will provide part of the raw material for Britain's young petroleum chemicals industry. The Petrochemicals Ltd. took its first cracking furnace into use early in 1949. It has virtually completed its plant at Partington near Manchester. The Shell Chemical Co.'s plant at Stanlow, Cheshire, came into operation in April and worked at capacity rate from July. The British Petroleum Chemicals Ltd., in which Anglo-Iranian Oil and Distillers cooperate, began construction work on its plant at Grangemouth where ethyl and isopropyl alcohols will be among the chief products. Imperial Chemical Industries Ltd. in the past year opened the first two plant units of its big new plant at Wilton-on-Tees which will eventually be the biggest works for the production of organic chemicals from petroleum outside the United States.

NEW INDUSTRIES

Among other new chemical industries started in Great Britain during the past year are three factories for the production of carbon black. Production of furnace black has already started in one of them, and the other two are expected to be working about the middle of next year. The total output from all three is to supply about half the country's requirements. Specialized carbon products are being made in a new factory at Hayes, near London. Plastics makers have proceeded warily with expansion projects, but the Distillers Co. completed its new factory at Barry and was gradually transferring manufacturing operations from existing factories to this new center where British Geon Ltd., a Distillers' subsidiary, greatly increased its polyvinyl chloride output in an adjoining plant. ICI's nylon polymer factory at Billingham went into large-scale production during 1949. Late in the year ICI also supplied larger quantities of the new "Terylene" polyester textile fibre and introduced a new plastic material, called "Fluon," with valuable electrical and heat resisting properties.

The outstanding event in the pharmaceutical field was the expansion of the penicillin and streptomycin. The latter is now produced by Glaxo Laboratories Ltd. in sufficient quantities to cover the whole home demand and leave a surplus for export. Distillers Co. developed plans for considerably

(Continued)


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Vein Quartz. Very large deposits of milky variety are easily accessible.

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**TYPICAL ANALYSIS OF SILICA GLASS SAND FROM ARBUCKLE MOUNTAINS**

*Average of Plant Run — 1947*

| | |
|---|---|
| $SiO_2$ | 99.829 |
| $Fe_2O_3$ | 0.036 |
| $Al_2O_3$ | 0.072 |
| CaO | 0.009 |
| MgO | 0.005 |
| L. O. I. | 0.072 |
| Total | 100.023 |

Detailed information on Oklahoma's mineral resources is available on request, based on data by the Oklahoma Geological Survey. Map showing location of mineral deposits is also available.

increasing the capacity of its penicillin factory at Speke, Liverpool. Other pharmaceutical manufacturers have also invested substantial funds in original research and plant extensions. The dyestuffs capacity has been steadily increased, and the 1949 output of synthetic dyes set a new record. In the field of established synthetic fibers progress has been steady rather than spectacular. Both leading rayon producers have brought new capacities into operation. Courtaulds Ltd. and British Celanese Ltd. have extended their plant for making chemicals used in the production rayon, Courtaulds at Trafford Park, Manchester, and Celanese at Spondon.

More plentiful supplies of most chemical raw materials permitted a substantial relaxation of quantitative and price restrictions, without causing wide fluctuations in market prices. Appreciable price changes occurred in comparatively few materials of chemical interest and were mostly due to parallel movements in the world market. After the devaluation some prices were adjusted to the increased cost of raw materials, but on the whole devaluation adjustments were slow in materializing. The advance in producing costs reported by most manufacturers was not reflected in prices for chemical products. On the other hand, price reductions of any significant extent occurred only for a few products. Most chemicals maintained stable prices throughout the year in line with the policy of leading manufacturers who have always tried to avoid major fluctuations. Relaxation of official control in many cases meant a return to prewar marketing and pricing arrangements. In the export field, however, British chemical manufacturers varied their prices in accordance with changing circumstances. While severe competition was met in some quarters, the price factor did not in general affect the export opportunities for British chemicals.

## Texas Finds New Oil Field In Colombia

Bogota—The Texas Petroleum Co. has discovered what seems to be a major oil field near Ortega, Tolima. Though no official statement has been issued yet, company officials are very optimistic about final results. The company has invested in Colombia $47,000,000 during 19 years of unsuccessful work. For Colombia, the new oil field would mean a great asset, since the principal field in the Carare region, Santander Department, shows signs of depletion. —End

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# The Corrosion Forum

EDMOND C. FETTER, *Managing Editor*

## Caustic Soda versus Construction Materials

*Part II of a symposium in which a representative group of construction materials are evaluated for services involving caustic soda.*

### Rubber Linings

E. L. Lockman, *United States Rubber Co., New York, N. Y.*

Rubber linings have been found suitable for handling all concentrations of caustic soda solutions. In the handling of weak caustic soda solutions the principal problem is to protect the solution from metallic contamination, and for this service soft natural rubber lining stocks are satisfactory for temperatures below 150 deg. F. For temperatures above 150 deg. F. and up to the boiling point of the liquid, hard, natural rubber stocks may be used.

Storage tanks, process vessels and pipe and fittings may be lined with this material and special linings are available for service conditions involving a combination of severe abrasion with either weak or strong caustic soda solutions.

Recent tests indicate that neoprene linings are excellent for handling very strong caustic soda solutions at elevated temperatures. One series of recent tests indicates that soft neoprene linings remain in good condition during long periods of exposure to a 70 percent caustic soda solution at 230 deg. F.

### High-Silicon Iron

Walter A. Luce, *Duriron Co., Dayton, Ohio*

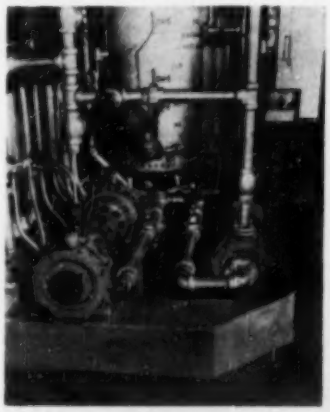
Caustic soda is one of the few chemicals for which the high-silicon iron alloys are not considered as superior materials of construction. Although these alloys show low and acceptable corrosion rates for certain low concentrations at moderate temperatures, the fact that they are not superior to cast iron restricts their application. However, in some instances the presence of other corrosive chemicals may preclude the use of cast iron, as well as many other caustic resisting alloys, and require the use of the high-silicon iron alloys.

The manufacture of sodium hypochlorite bleach involves corrosion problems of this type for which the high-silicon irons, Duriron and Durichlor, find wide application. The materials of construction utilized in this service must be resistant to caustic soda, chlorine gas and the resultant sodium hypochlorite bleach. The bleach is usually made by recirculating a caustic solution with continuous additions of chlorine until the desired end point is reached. Numerous manufacturers utilize Duriron and Durichlor as standard materials of construction because of their good resistance to these corrosives at the ambient temperatures necessary for stable bleach manufacture. Many installations of this type are made almost entirely from high-silicon iron equipment; that includes pumps, valves, pipe, heat exchangers for cooling, hydraulic ejectors for chlorine introduction and tank outlets. The various tanks utilized are often the only equipment not made from the high-silicon iron alloys.

In a similar service, one large alkali manufacturer also uses Duriron pumps for recirculating cold caustic soda to absorb waste chlorine gas which would normally escape to the atmosphere.

Duriron is a high-silicon iron with a nominal chemical composition of 14.5 percent Si, 0.75 Mn and 0.90 C max. Durichlor contains an additional 3 percent Mo to the above analysis which results in increased resistance to hydrochloric acid, chlorine gas and other chlorine containing corrosives. Both alloys are supplied in the cast form only and due to their extreme hardness, any required machining must be accomplished by grinding methods. The forms of chemical equipment which can be supplied in these alloys include pumps, valves, spray nozzles, tank outlets, fans, ejectors, jets, pipe and others. Laboratory equipment, tower sections, kettles, concentrator tubes, heat exchangers and immersion heaters are produced in Duriron only.

Duriron and Durichlor provide equivalent resistance to caustic soda, and the more expensive Durichlor is required only where it will provide additional corrosion resistance such as for handling bleach solutions in excess of 15 percent sodium hypochlorite.



**DURIRON PUMP handling caustic soda in a sugar refining plant. A larger disconnected Duriron pump stands nearby.**

### Stainless Steel

W. G. Renshaw, *Allegheny Ludlum Steel Corp., Brackenridge, Pa.*

The stainless steels offer satisfactory service in many applications involving sodium hydroxide solutions, particularly at intermediate and dilute concentrations. Concentrated solutions can be handled by the stainless steels at low temperatures.

While the straight chromium grades, Type 410 and Type 430, have been useful in some applications where very dilute sodium hydroxide solutions are employed or where temperatures are very low such as during storage, the chromium-nickel grades are generally more suitable for caustic soda service. The presence of nickel in Type 304 (18 percent Cr, 8 Ni) causes a marked increase in corrosion resistance over that shown by the straight chromium Type 430 (17 percent Cr) in caustic soda.

Type 304 and Type 316 offer good resistance to boiling caustic soda solutions up to 10 percent concentration, but above this concentration the temperature limit for satisfactory service probably would not exceed 200 deg. F. While Type 304 and Type 316 suffer practically no corrosion attack even

(*Continued*)

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But corrosion respects no arbitrary division between power and processing equipment, and operators, recognizing like conditions of service, have, for example, extended Dampney wet-heat protection from boilers and turbines to sterilizing retorts, bonderizing and parkerizing tanks, or steam accumulators. And when one product proved outstandingly successful, they have turned to us with other corrosion problems.

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THE DAMPNEY COMPANY OF AMERICA

HYDE PARK, BOSTON 36, MASS.




up to the boiling point at concentrations of 50 percent sodium hydroxide or lower, and would offer a good service life under such conditions, the formation of a sludge on the surface of the metal in some instances is likely to discolor the sodium hydroxide somewhat which might be objectionable in certain types of application. If complete freedom from contamination is necessary the stainless steels would not be suitable for the higher sodium hydroxide concentrations at high temperatures.

Stainless steel does not offer any better service than ordinary carbon steel in handling fused caustic soda, and therefore is rarely used for this purpose.

Where stainless steels are employed for caustic soda applications, Type 304 is usually selected, since Type 316 does not offer any appreciable improvement in corrosion resistance with this particular type of solution.

The wide application of stainless steels in various industries using caustic soda in their processes is possible because of the good resistance these alloys show at low concentrations and temperatures. The chromium-nickel stainless steel grades are suitable for steeping tanks, mixers and other equipment employed in processing viscose rayon which includes the use of caustic soda. Other applications such as soap processing kettles and soda pulp equipment offer some uses for the stainless steels.

### Cements

RAYMOND B. SEYMOUR, *Atlas Mineral Products Co., Mertztown, Pa.*

Sulphur base, phenol-formaldehyde, phenol-furfural and sodium silicate acid-resistant cements are all attacked by caustic soda even in dilute concentrations and at room temperature, but cements based on polymers of furfuryl alcohol or furfural with carbon filler have given satisfactory service for many years with all concentrations of caustic soda even at elevated temperatures. The use of carbon instead of silica as a filler in phenolic cements improves the resistance to weak alkalis such as sodium bicarbonate, but phenolic cements are not sufficiently resistant to dilute caustic soda even at room temperature to permit their use in materials of construction.

Extensive laboratory tests in aqueous solutions of sodium hydroxide ranging in concentrations from 10 to 40 percent at temperatures ranging

(*Continued*)

# This manual on drain lines will help you cut replacement costs

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DURCO Adv. 77-GM

## WHAT YOU WILL FIND IN THIS BULLETIN

***A description of the high-silicon iron, Duriron***

- Composition
- Advantages
- Physical properties
- Tests of corrosion-resisting ability

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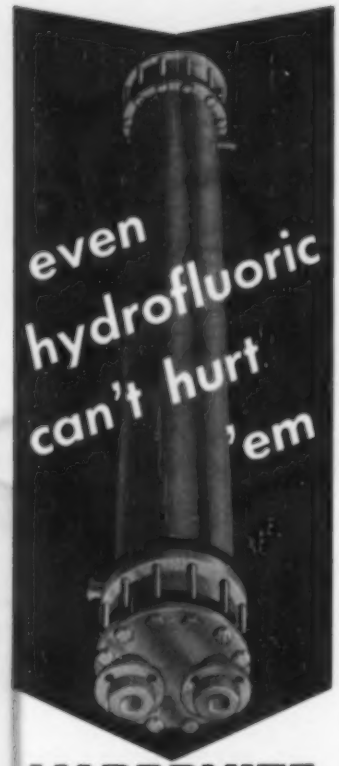


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*Falls Industries, Inc.*




from 70 to 210 deg. F. on several commercially available polyfurfuryl alcohol cements has shown a maximum loss in weight of from 3 to 5 percent during the first 30 days of test. No further change was indicated over longer periods of time but one commercial resin cement, said to be resistant to both acid and alkali, disintegrated completely during the first 30 days in all concentrations of caustic soda at 212 deg. F.

Melt cements based on asphalt with non-siliceous fillers are resistant to all concentrations of caustic at temperatures up to 140 deg. F.

Melt cements based on coumarone resins and ethyl cellulose are also resistant but most cellulose derivatives are unsatisfactory for use with caustic soda.

A commercially available cement based on a modified polymer of furfuryl alcohol with carbon filler has given satisfactory service for more than eight years for such applications as floors, reaction vessels, sumps, and drains in contact with both dilute and concentrated caustic soda at temperatures ranging from room temperature to boiling.

## Not Recommended

### Chemical Stoneware

Strong hot caustic attacks chemical stoneware, as it does all other siliceous materials. For concentrations over 25 percent at temperatures over 80 deg. C., stoneware is therefore not suitable.—F. E. HERSTEIN, *General Ceramics & Steatite Corp.*, Keasbey, N. J.

### Aluminum

It is generally known that sodium hydroxide in any appreciable concentrations is corrosive to aluminum. According to McKee and Brown (*Corrosion*, Dec. 1947) the rate of corrosion of 2S-H14 alloy in caustic soda at room temperature varies from about 0.7 mils per yr. for a 0.0001 N solution to about 1,670 mils per yr. for a 0.1 N solution. These rates are not greatly influenced by addition of sodium chloride. Sodium chromate is not an effective inhibitor for caustic soda solutions of normalities above about 0.01 N solution.—ELLIS D. VERINK, JR., *Aluminum Co. of America, New Kensington, Pa.*

### Tantalum

Caustic soda and most other alkalis, even in weak solutions, attack tantalum.—ALLAN L. PERCY, *Fansteel Metallurgical Corp., North Chicago, Ill.* —*End*


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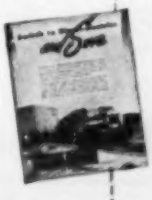

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"This plant also starts the filter presses on gravity feed. In this connection two bad practices were noted. First, if they do not need the filter right away it is allowed to drizzle at a very low flow, probably allowing some settling of filteraid. Second, when they do turn over to the pump feed, their practice is to shut off the gravity feed before turning on the pump feed. This, of course, makes it possible for the filter cake to fall off, or at least be disturbed.

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# Names in the News

## MAN OF THE MONTH

***Frederick E. Frey***

Frederick E. Frey, assistant director of research of the Phillips Petroleum Co., Bartlesville, Okla., who helped develop a new and cheaper process for making high test aviation gasoline in World War II, has been chosen to receive the second Southwest Regional Award of the American Chemical Society.

The award, given annually for outstanding achievement by a southwestern chemist or chemical engineer, goes to Dr. Frey for major contributions in the field of petroleum chemistry during the past quarter century. Sponsored by 19 local sections of the society, the award consists of a bronze plaque and $200.

Dr. Frey conducted fundamental research in the field of catalytic dehydrogenation which was of great value to the nation's synthetic rubber program. Other work by Dr. Frey resulted in a commercial furnace process for the production from gas oil of carbon black, the sooty chemical widely employed to toughen automobile tires. The use of anhydrous hydrogen fluoride as a catalyst in producing aviation gasoline was an important wartime advance, and development of a successful production program along this line was due in great part to Dr. Frey's efforts.

Born in Canton, Ohio, in 1899, Dr. Frey received the B.S. degree from the College of Wooster in 1922 and the M.S. from Ohio State University in 1924. Last year, he was awarded the honorary degree of doctor of science by the College of Wooster. At the outset of his career, he taught for a year at Wooster, spent the following year as an analyst with the Ohio Agricultural Experiment Station, and then served three years as an assistant chemist at the United States Bureau of Mines Pittsburgh Experiment Station. He joined the Phillips Petroleum Co. in 1927 as chief chemist in the research department.

Dr. Frey has received 90 patents in the United States and 55 patents in 13 foreign countries. He is coinventor of 58 other United States patents, and author of 22 published articles dealing mostly with hydrocarbon chemistry.

Dr. Frey, one of the charter members and a former chairman of the Oklahoma Section of the ACS, is also a member of Phi Beta Kappa, Sigma Xi, Phi Lambda Upsilon, and Gamma Alpha.

---

**Karl J. Brunings** has been appointed assistant director of chemical research and development, Chas. Pfizer & Co., Brooklyn, N. Y. **Frederick J. Pilgrim** and **Charles I. Jarowski**, member of the research staff have been named research supervisors.

H. K. Brunings

R. C. Hood

**Robert C. Hood** has been elected president of Ansul Chemical Co., Marinette, Wis., succeeding his brother, the late **F. James Hood. Leonard C. McKesson** has been named vice president in charge of sales and **Arthur C. Pope**, vice president in charge of manufacturing.

**N. Howell Furman** has been chosen president elect of the American Chemical Society for 1951.

**Warren L. McCabe**, vice president and director of research of the Flintkote Co., has been elected president of the American Institute of Chemical Engineers.

**Randall Whitaker** has been made director of the dairy technology department of National Dairy Research Laboratories, Inc., Oakdale, N. Y.

**Elliott V. Bell**, formerly superintendent of banks of the state of New York, has been named chairman of the executive committee of McGraw-Hill Publishing Co., Inc., New York. He will assist in the formulation and development of publishing and editorial policies for the Publishing Co., the Book Co., and the International Corp. Mr. Bell has been a director of the Publishing Co. and the Book Co. since December 1947, and is a director of the American Agricultural Chemical Co. He was a member of the editorial board of the *New York Times* from 1941 to 1942 and was first president of the New York Financial Writers Association. He is a graduate of Columbia University.

**Marvin J. Hall** has been appointed associate director of research for Lever Brother Co. **C. T. Walling** has been made chief supervisor of organic research. They will be located in Cambridge, Mass.

M. J. Hall

R. E. Price

**R. E. Price**, chief chemist of Crosby Chemicals, Inc., has been elected vice president of the corporation. Mr. Price joined the company in 1937 as research chemist. He developed its process of making pale wood rosin.

**Robert F. Mehl**, director of the metals research laboratory and head of the metallurgical engineering department of Carnegie Institute of Technology, has been appointed a member at large of the National Research Council of the National Academy of Sciences.

**Fred C. Bowman** has retired from his position as vice president and director of research of the A. R. Maas Chemical Co., South Gate, Calif.

**Ralph L. Shriner**, professor of organic chemistry at the University of Iowa, has been appointed editor of Chemical Reviews, a bimonthly publication of the American Chemical Society. He succeeds W. Albert Noyes, Jr., of the University of

(*Continued*)

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NAMES IN THE NEWS, cont. . .

Rochester who has been made editor of the Journal of the American Chemical Society.

**William J. Morse** has retired from the U. S. Department of Agriculture. He is the author of "The Soybean," a standard work on the subject.

**Harry S. Rogers**, president of Polytechnic Institute of Brooklyn, Brooklyn, N. Y., has been elected chairman of the Engineers' Council for Professional Development.

**William A. Bolhofer** has joined the organic chemical research staff of Sharp & Dohme's medical research division. **John A. Fiedler** has been appointed to the products development staff.

**Clifford A. Hampel** has been named supervisor of extraction metallurgy at Armour Research Foundation of Illinois Institute of Technology. He formerly headed the inorganic technology program of the ceramics and minerals department.

**Martin T. Bennett**, consulting engineer, has moved his Washington, D. C., offices to 1627 K St.

**Robert Fulton** has been appointed superintendent of the plastic metals division plant of the National Radiator Co., Johnstown, Pa. He was formerly production manager of the eastern division of the Indiana Steel Products Co., Chauncey, N. Y. **John E. Harris** has been appointed technical adviser to the vice president for manufacturing.

**Walter M. Scott** and **John R. Matchett** have been appointed assistant chiefs of the U. S. Department of Agriculture's Bureau of Agricultural and Industrial Chemistry. **Charles H. Fisher** has succeeded Dr. Scott as director of the Bureau's Southern Regional Research Laboratory in New Orleans.

**James E. Blackburn, Jr.**, vice president of McGraw-Hill Publishing Co., New York, N. Y., has been made a trustee of Rensselaer Polytechnic Institute for a term of four years.

**Robert B. Coleman, Jr.**, has been made a general research engineer with Southern Cement Co., Birmingham, Ala.

**Robert B. Taylor** has been appointed director of research for the newly created Structural Clay Products Research Foundation, Washington, D. C. Mr. Taylor was previously assistant director of research for Owens-Corning Fiberglas Corp. in charge of the research programs of the Fiberglas Basic Research Laboratories.

**Robert S. Casey**, chief chemist of the W. A. Sheaffer Pen Co., Fort Madison, Iowa, has been awarded the 1949 Iowa Medal of the American Chemical Society's Iowa section.

**Oliver DeGarmo** and **Ferdinand C. Meyer** have been made group leaders in the organic chemicals division research department of Monsanto Chemical Co., St. Louis, Mo.

**H. Meininger** has been appointed chemist for the Chemical Plants Corp. division of Oscar Kohorn & Co., Ltd.

**Earle E. Langeland** has been appointed operations manager for American Maize-Products Co., Roby, Ind. **W. J. Kennedy, K. I. Aspman**, and **G. G. McGeorge** have been made material control superintendent, superintendent of specialized services and starch and packaging division manager, respectively.

**Lincoln R. Thiesmeyer** has been appointed president of the Canadian Pulp and Paper Research Corp. He was formerly executive assistant to the director of Brookhaven National Laboratory, Upton, N. Y.

**Milton A. Karp** has been appointed chief engineer of the Luria Engineering Corp., New York, N. Y. He will head the company's engineering department in Bethlehem, Pa. He was formerly chief engineer for Ellis Wing Taylor, West Coast industrial designers.

**Joseph J. Schaefer**, chemical consultant, has established an office at 50 East 41st St., New York, N. Y.

**Irving L. Lyons**, chairman of the board of I. L. Lyons and Co., Ltd., manufacturing chemists, New Orleans, La., has retired to be succeeded by **Theodore H. Lyons**, who has been serving as president. **Edmund B. Briggs**, senior vice president, has been elected president.

**F. Homer Bell**, southern representative of the Philadelphia Quartz Co., has been elected chairman of the Georgia section of the American Chemical Society for 1950. **X. W. T. Ziegler**, research professor of chemical engineering of Georgia

(*Continued*)

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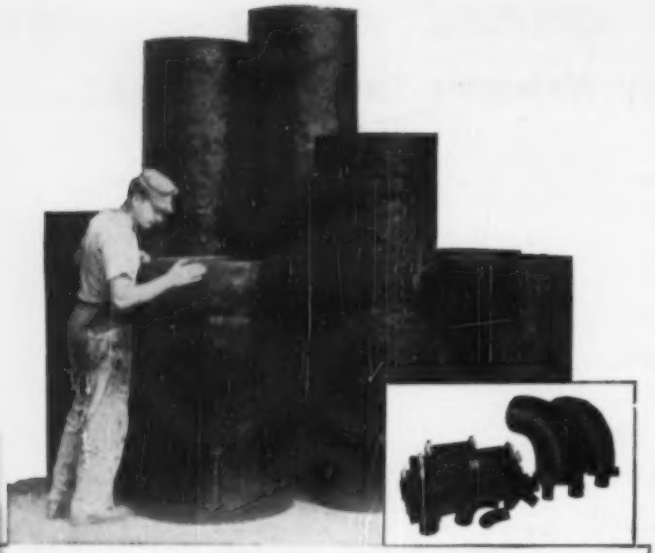

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**Acid and Alkali-proof Chemical Equipment**

NAMES IN THE NEWS, cont. . .

Tech Engineering Experiment Station, has been named chairman-elect for 1951.

**Kenneth A. Dunbar,** formerly manager of the Dayton, Ohio, area of the Atomic Energy Commission, has been named director of the Office of Production and Engineering in the AEC's office at Oak Ridge Operations.

**H. V. Churchill,** chief of the analytical chemistry division of Aluminum Co. of America's research laboratories, New Kensington, Pa., has been selected to receive the 1949 Pittsburgh Award of the American Chemical Society.

H. V. Churchill

A. P. Weber

**A. P. Weber** has been named technical director of International Engineering, Inc., of Dayton, Ohio. He was formerly director of process development and process engineering for the Kellex Corp., New York, N. Y.

**William H. McAdams,** professor of chemical engineering, Massachusetts Institute of Technology, has received the William H. Walker Award of the American Institute of Chemical Engineers.

**R. A. Bardwell** has been appointed engineer for tests for the Chicago and Eastern Illinois Railroad with headquarters at Danville. For the past ten years he has been connected with the National Aluminate Corp., Chicago.

**Noble E. Hamilton** has joined National Research Corp., Cambridge, Mass., to take part in research in the application of high vacuum to high temperature alloys.

**Leslie Boatright, Paul F. Hopper, Donald J. Berets, G. W. Kennerly** and **R. P. Price** have joined the staff of the research division at the Stamford research laboratories of the American Cyanamid Co.

**Daniel H. Terry** has been made manager, technical service for Antara

Products, General Aniline & Film Corp., New York, N. Y.

**Edward G. Scheibel** of Hoffman La Roche Inc. has been chosen to receive the Junior Award of the American Institute of Chemical Engineers.

**L. Coleman Hall** has been made manager of the Hattiesburg, Miss., naval stores plant of Hercules Powder Co. He succeeds **Charles A. Lambert** who has retired.

**Roger Adams**, professor at the University of Illinois and chairman of the board of directors of the American Chemical Society, has been awarded honorary membership in the American Institute of Chemists.

**Fred G. Baker** has been made director of engineering and design for the Electro Chemical Supply & Engineering Co., Emmaus, Pa.

**Vincent C. Hall** has joined the staff of the applied physics department of National Research Corp., Cambridge, Mass.

**Vannevar Bush** has been elected a director of Merck & Co., Inc., Rahway, N. J.

**Harvey M. Merker**, superintendent of manufacturing, for the Parke, Davis & Co., Detroit, has been elected one of five trustees of the Kresge Eye Institute. He has also been made chairman of the advisory committee to the university administration in connection with the University of Michigan-Phoenix Fund for isotope research as applied to medicine and industry.

**M. P. Venema** has been elected vice president of Universal Oil Products Co., Chicago, Ill.

**Wendell P. Metzner** has been appointed research director for the rubber service department of Monsanto Chemical Co.'s organic chemicals division at Nitro, W. Va.

**Henning A. Trebler** has been appointed director of engineering research and development at National Dairy Research Laboratories, Inc., Oakdale, N. Y.

**Thornton B. Sparrow, J. K. Albringt, G. R. Lucas, L. L. Goehring** and **John F. Bennett** have joined the staff of the Industrial Research Institute of the University of Chattanooga to be engaged in the Fairchild Engine Corp. project at Oak

(Continued)


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**A large variety of standard valves and fittings are available in three general pressure ranges —25,000, 60,000, and 100,000 psi— in such types as straightway, angle, cross, check, relief, combined inlet and bleeder, etc.**

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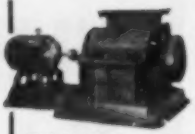

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WIRE PRODUCTS SINCE – 1880


NAMES IN THE NEWS, cont. . .

Ridge, Tenn. They will do analytical work.

**D. H. W. Felch,** formerly manager of the Willow Island plant, has been appointed chief engineer of the American Cyanamid Co. **J. W. Dykes,** assistant manager of Willow Island, succeeds Mr. Felch as manager.

**Dudley W. Figgis,** president of the American Can Co., has been elected a vice chairman of the board of trustees of Stevens Institute of Technology, Hoboken, N. J.

**John L. Gillis** has been elected president of Nealco-Monsanto Co., Boston.

**G. S. Tarnowski** and **Wilson Cain** have joined the antibiotic research staff of Sharp & Dohme Inc., Philadelphia. **E. H. Unger** and **Werner Baumgarten** have joined the pharmaceutical and immunochemical research staffs respectively.

**James P. Margeson, Jr.,** executive vice president of International Minerals & Chemical Corp., Chicago, has been elected a director.

**A. C. McAuliffe,** chief of the Chemical Corps, Department of the Army, has been designated an Army member of the committees on chemical warfare and biological warfare of the Research and Development Board, Department of Defense.

**A. Neil Lilley** has been appointed general manager of foreign operations, Eastern Hemisphere, for the Texas Co.

**Bernard W. Weber** has been appointed manager of Metal & Thermit Corp.'s detinning and electrode manufacturing plant at East Chicago, Ind. **W. S. Leinhardt,** formerly general superintendent of the East Chicago plant, has been made technical assistant to the vice president of production located in New York.

**Roland S. Young** has resigned from his position of chief research chemist to Rhokana, Nchanga, and Broken Hill companies of Northern Rhodesia to become director of the Diamond Research Laboratory in Johannesburg.

**George G. Brown,** chairman of the department of chemical and metallurgical engineering at the University of Michigan, has been named

director of the U. S. Atomic Energy Commission's division of engineering.

**Patricia H. Kelley** has been made a research group director of Foster D. Snell, Inc., New York.

**H. S. Cole** has been made manager of the drug products division of Procter & Gamble Co., Cincinnati.

**Geoffrey K. Wright** has been elected chairman of the executive committee of the Toronto section of the Chemical Institute of Canada.

**Paul M. Arnall** has been made vice president and general manager of the Lunkenheimer Co., Cincinnati.

**Joseph M. Temple** has been made manager of the Baton Rouge, La., branch office of Foxboro Co., Foxboro, Mass.

**Donald A. Gaudion** has been made assistant to the president in charge of sales and advertising for the Pfaudler Co., Rochester, N. Y. **William H. Klee** has been named general sales manager and a director and vice president of Pfaudler Sales Co.

**Raymond K. Serfass** has been named assistant general sales manager of the York Corp., York, Pa. **John G. Bergdoll, Jr.**, vice president and works manager of the company, has been elected president of the American Society of Refrigerating Engineers.

**J. H. Berryman** has been appointed assistant to the manager, technical sales division of Air Reduction Sales Co., New York.

**Everett P. Russell** has been named director of sales and customer relations for Texas Gas Transmission Corp., New York. **Duncan K. Foulds** and **Monty G. Martin** have been named to staff the firm's new Shreveport, La., office.

**Max Christensen** has been appointed supervisor of plastic sales for the Chicago territory of Dow Chemical Co., Midland, Mich.

**M. G. Wicker** and **H. T. Wadley** have been elected vice presidents of the Magnolia Airco Gas Products Co., New York.

**William W. Martenis** has been appointed manager of sales engineering of the Minneapolis-Honeywell

(*Continued*)


## Acidproof Cements

USE—FILE #27-2

Physical strength as well as acid resistance is important for acidproof construction. A test block made by bonding 100 mesh sand with S Special Silicate had a tensile strength of 250 lbs. per square in. Using equal parts of 100 mesh and 20 mesh sand, the air dried block tested 1700 lbs. For use with quick-setting, prepared acidproof cements—S Special (1:3.75) "N", N380 (1:3.22) silicates.

## Float Valuable Ores

USE—FILE #27-5

Soluble silicates used to depress siliceous gangue slimes permit the valuable metallic particles to be floated off in the froth. "N" is the silicate usually specified although for some ores, for example pitchblende and oxidized ores, more alkaline silicates increase overall recovery. In one study increases were gold 6.7%, silver 5.3%, lead 10.7%, copper 13.8%, by adding only one pound of Metso Granular per ton of ore.

SILICATE P's & Q's

For more information on these silicate uses ask for the file numbers.

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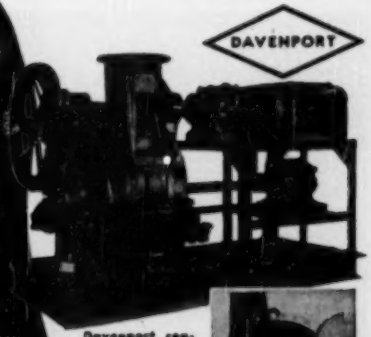

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Cross section of press

Davenport continuous presses, continuous screens, rotary steam tube, direct fired and hot air dryers are making it possible for chemical, glucose, starch, food processing, rubber reclaiming plants, packing houses, breweries and distilleries, as well as many allied industries, to extract excess moisture and dry their products at the lowest possible cost.

We design, fabricate, and supervise the installation of complete drying plants. Your absolute satisfaction is guaranteed by the undivided responsibility of a single source of supply.

Write for our catalog A.

Davenport rotary dryers available in steam tube, direct fired and hot air models.

DAVENPORT Machine and Foundry Co. Davenport Iowa U.S.A.

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- **COMPLETE STOCKS**
- **PROMPT DELIVERY**

Call Sperry today for immediate delivery on any type . . . any size . . . filter base for industrial use. Stocks include cotton, wool, paper, nylon, vinyon, glass, asbestos, rubber, woven metals and other materials . . . all calculated to help you get maximum efficiency in your filtering operation. And . . . for help in selecting the right base for your particular application, depend on a Sperry engineer.

**D. R. SPERRY & COMPANY**
BATAVIA, ILLINOIS
*Filtration Engineers for over 50 years*

SPERRY FILTER BASES

## DRYERS — DRYERS — DRYERS

**STANDARD** Rotary dryers are used throughout the world. **STANDARD** dryers are competently engineered and sturdily built in a wide variety of types and sizes for drying various products, such as fish meal, garbage, tankage, humus, fertilizer, sewage, sludge, agricultural products and countless chemicals. Stock designs available in sizes of 2 feet to 10 feet diameters. Let our engineers help you with your problems—regardless of your location.

We welcome your inquiries.

**STANDARD STEEL CORPORATION**
*Engineers—Manufacturers*
5005 Boyle Avenue — Los Angeles, Cal.


NAMES IN THE NEWS, cont. . .

Regulator Co. He will coordinate activity between the sales and engineering department.

**Joseph B. Dietz** has been appointed manager of the industrial sales section of the finishes division of the Du Pont company. He succeeds **Henry E. Lackey** who has retired.

**Richard Morton** has been appointed the eastern representative of the Born Engineering Co., Tulsa, Okla. He will be located in New York City.

**Morse G. Dial** has been elected a director and **Kenneth H. Hannan** secretary of Union Carbide and Carbon Corp., New York.

**Homer A. Goddard, Jr.,** has been named assistant general manager for industrial marketing for Gulf Oil Corp., Pittsburgh, Pa.

**Carl W. Preising** has been made vice president and general sales manager of Dayton Rubber Co. **Herbert S. Waters** has been made vice president and director of products.

**A. M. Shaw** has been appointed assistant manager, pump and compressor merchandising division, Worthington Pump and Machinery Corp., Harrison, N. J.

**Bernard M. Costello** has been named vice president of manufacturing and **William E. Ireland** vice president of sales for International B. F. Goodrich Co.

**Barclay K. Read** has resumed the duties of assistant sales manager of the Eastern division after two years in management of western division sales for Shell Chemical Corp.

**J. Frank Greeley** has been appointed general manager of the multiwall division, Fulton Bag & Cotton Mills, New Orleans.

**Milton L. Huemme** has been made manager of coke sales for Diamond Alkali Co., Cleveland.

**L. E. Whittelsey,** Macon, Ga., has been appointed sales representative of the Crossett Chemical Co. to cover the southeastern territory of North and South Carolina, Alabama and Georgia.

**Bert W. Whitehurst** has joined Anderson-Nichols & Co., Boston, as project engineer. For the past eight years he has been with Stone &

Webster Engineering Corp., Boston.

**Charles A. Thomas**, executive vice president of Monsanto Chemical Co., St. Louis, Mo., has been elected chairman of the board of directors of the American Chemical Society.

**B. Bynum Turner** has been appointed general manager of manufacturing in charge of the Ethyl Corp.'s activities in Baton Rouge, La.

B. B. Turner

L. J. Howell

**Leaston J. Howell** has been elected a director and made vice president of operations for the Acme-Hamilton Mfg. Co.'s two Trenton plants for the manufacture of mechanical rubber goods.

**Howard F. Roderick** has been made general sales manager of Wyandotte Chemicals, Wyandotte, Mich. **Paul M. Bigley** has been named to assist him.

**George S. Forbes** has been made manager of the Glidden Co.'s Cleveland industrial sales division. He succeeds **Edward C. Shurtleff** who has retired.

**Wilbur H. Miller** has been named technical representative and assistant manager of American Cyanamid Co.'s Washington, D. C. office.

**Clarence J. Krueger** has been appointed production manager for the paint division of Pittsburgh Plate Glass Co., Pittsburgh, Pa.

**Brook J. March** has been appointed manager of sales of the National Foam System, Inc., Philadelphia.

**Stephen C. May** has been named vice president and general sales manager of Blackmer Pump Co., Grand Rapids, Mich.

**Sam Stroum** has been appointed sales representative for Clarostate Mfg. Co., Dover, N. H., in the territory of Washington, Oregon, Idaho and Montana. His headquarters are in Seattle, Wash. **W. H. Connor**, with

(*Continued*)

Now! GET ALL LEATHER GLOVES WITH
SEAMS THAT DEFY ACID
1 BETTER BECAUSE they're sewn with acid resistant thread.
2 BETTER BECAUSE they're made of smooth, all leather side horsehide.
3 BETTER BECAUSE no fibrous leather let to contaminate chemicals.
4 BETTER BECAUSE seams won't give away to acid, assuring full life to the glove as to the leather itself.
5 PROVEN BETTER by 20% to 30% by one of America's foremost chemical manufacturers.
Other gloves available besides side horsehide. If you've a particular glove problem write, Illinois "Special Glove Department" stating fully your needs. We are equipped to make gloves to fill the most exacting specifications.
It's revolutionary . . . a glove with seams that will last as long as the leather itself because they're sewn with acid resistant thread. Banish forever that costly habit of discarding gloves before they're worn out. Get all the wear from every pair.
ILLINOIS GLOVE CO
CHAMPAIGN, ILL
WRITE FOR SAMPLES

CONCENTRIC SWAGE
RECESSED VAN STONE FLANGE
BACK OUTLET
ROLLED VAN STONE END
90° ECCENTRIC OUTLET
45° ECCENTRIC OUTLET
ECCENTRIC SWAGE
ROLLED VAN STONE ENDS
Stainless Steel Piping
Engineered And Pre-Fabricated
Fifteen years ago, we pioneered in developing methods for welding and shop pre-fabrication of stainless steel piping for one of the world's largest food canning companies. We've gained much experience since, and today, we use the latest "inert-gas-shielded-arc" welding, which has only been available for commercial use since the war. The illustration gives some idea of "what-we-can-do" in stainless. Insides of welds and joints can be made absolutely smooth. Our experience in power and process piping dates back forty-eight years and today most utilities and large industrial plants know the perfection of our patented Westport Welded Joint and other high pressure, high temperature pipe engineering and pre-fabrication. Write us, or send us prints for an estimate.
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REPRESENTATIVES IN BOSTON, NEW YORK, CLEVELAND, MOBILE AND HAVANA
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PIPING FABRICATORS AND CONTRACTORS

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**THAT PROVIDES:**

- Low Cost POWER
- Adequate WATER Supply
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- Low Cost PLANT Sites

**The GRDA District in the magic circle of the growing Southwest has Plant Locations available on a non-profit basis: Hydro-Electric power, firmed up by steam plant, as low as 5.3 mills per KWH: Water, 75 million gallons daily at Cost of Production.**

*If such profit factors as these are of interest to you, write for specific information on the special advantages GRDA offers your type of industry — This service is free.*

**GRAND RIVER DAM AUTHORITY**
**VINITA, OKLAHOMA**
AN AGENCY OF THE STATE OF OKLAHOMA

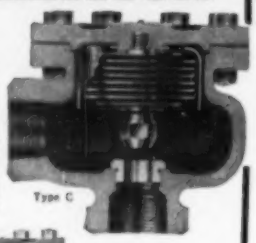


Leading Processor

# SHORTENS OPERATION from 65 to 45 Min.

**with Nicholson Steam Traps**

Records of a recent installation of Nicholson steam traps, by a large food packer, show they cut cooking time 30%; e.g., one operation was shortened from 65 to 45 min. Nicholson units keep equipment full of live steam because: 1) they operate on lowest temperature differential; 2) have 2 to 6 times average drainage capacity. Also record low for steam waste; and maximum air-venting capacity. Widely specified for preventing damage to thin gauges; eliminate cold blow in unit heaters.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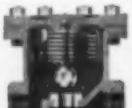
Type B

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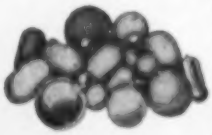


5 TYPES FOR EVERY PURPOSE—Size ¼" to 2"; press. to 225 lbs. **BULLETIN 1047.**

HIGH-PRESSURE FLOATS—Stainless, monel, steel or plated steel. Welded. In all sizes and shapes; for operating mechanisms and as tanks or vessels. 2-day delivery. **BULLETIN 348.**

**W. H. NICHOLSON & CO., 206 Oregon St., Wilkes-Barre, Pa.**


## Names in the News, cont. . .

headquarters in Denver, has been chosen to cover Wyoming, Utah, Colorado and New Mexico.

**William F. Nesbit** has been added to the sales staff of the Texas sales division of Arkell and Smiths.

**Walter S. Keutzer** has been appointed assistant sales manager, western division, of the Mallinckrodt Chemical Works, St. Louis, Mo.

**William Klabunde** has been added to the patent department of Houdry Process Corp., Philadelphia.

**A. E. Pecore** has been made general superintendent of Humble Pipe Line Co., Houston, Tex.

**A. G. Benard** has resigned from the Illinois Electric Porcelain Co. where he was vice president and director.

**J. A. Cuneo** has been transferred to Chicago to assume the duties of manager of the Chicago branch of Fairbanks, Morse & Co. He succeeds **John S. King** who has been moved to Cincinnati as branch manager of that sales area.

**Norman C. Moore** has been appointed manager of Abbott Laboratories' newly-created sales district in the Northwest. His headquarters are in Portland, Ore.

**J. K. Gillenwater** has been named purchasing agent of Tennessee Eastman Corp., Kingsport, Tenn. **W. J. Jackson** succeeds him as assistant purchasing agent.

**Emmett E. Hixon** has been added to the Wilmington sales office of Hercules Powder Co. where he will work on promotion of cellulose acetate plastics.

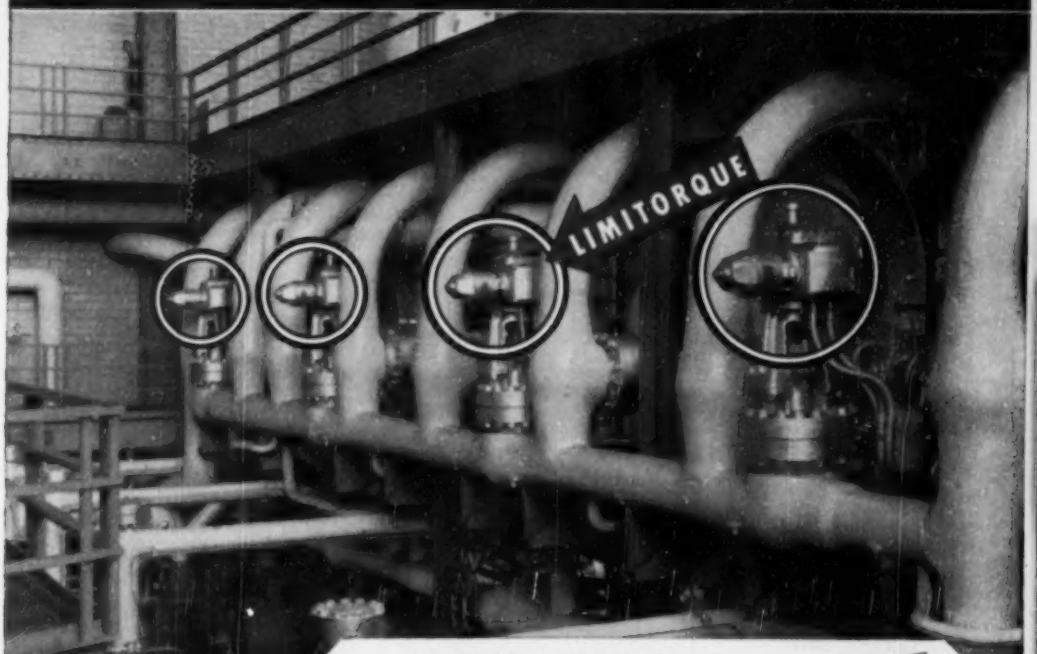
**C. G. Gran** has been appointed manager, agricultural sales development, Mathieson Chemical Corp., Baltimore.

**John P. Knight** has been named assistant general sales manager of special accounts for Gulf Oil Corp. **L. F. Craig** has been made general sales manager of special products; **R. C. Arnold**, general sales manager of divisional market development. **W. A. Berryman** has assumed direction of foreign marketing operations.

**E. H. van Delden**, formerly director of industrial relations for Libbey-

(Continued)

# REMOTE CONTROL
## *IS SIMPLE, SURE AND SAFE*




**WITH LIMITORQUE**
**VALVE OPERATORS**

One man, at a panel control board, can *merely push a button* and open or close any size or type of valve . . . any distance away . . . in hard-to-get-at or dangerous locations. Too, *LimiTorque* saves considerable money over the manual method of operating valves . . . and may be supplied for actuation by any power source, such as electricity, steam, water, gas, oil or air.

Thousands upon thousands of *LimiTorques* are in use throughout the world, on land and sea.

Send for this 96 page Illustrated Catalog . . . and please use your business letterhead when writing for it.

# Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON
IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

*Industrial Gears and Speed Reducers*
*LimiTorque Valve Controls*

# Atlantic Pump
CORPORATION

*announces*

# a new and revolutionary centrifugal pump

- No seals or stuffing box of any kind are required.
- No lubrication of pump or motor is required at any time.
- No coupling—since motor and pump are one integral sealed unit—eliminating all shaft alignment problems and attendant wear and replacement of parts.

## THE MOTOR AND PUMP ARE COMBINED IN ONE HERMETICALLY SEALED UNIT

The new Atlantic pump* is a self-contained axial air-gap pump and magnetically driven motor combination, which has been thoroughly field tested, and is manufactured by an outstanding producer of machine tools—your guarantee of dependable quality and high performance.

- Handles all types of fluids pumpable in conventional centrifugal pumps
- All capacities and electrical characteristics
- Only one moving part
- Smaller and more compact
- Universal in-the-line or base mounting

Write for basic specification sheet on company letterhead.

*Patents Pending*

**Atlantic Pump Corporation**

P. O. Box 6731
4272 Wissahickon Ave.
Philadelphia, Pa.


NAMES IN THE NEWS, cont. . .

Owens-Ford Glass Co., has been appointed professor of industrial relations at the New York University school of business.

**George L. Curran** has been appointed to the sales staff of the rubber specialties division of the Dewey and Almy Chemical Co., Cambridge, Mass.

**Walter A. Kesterke** has been appointed sales representative for industrial grinding wheels for the United States Rubber Co., New York.

**J. Robert Bunch** has been appointed sales representative to assist in the Cleveland sales office of American Wheelabrator and Equipment Corp., Mishawaka, Ind.

**Stuart A. Whitehurst** has been made Pacific Coast representative of Selas Corp. of America, Philadelphia. He will be located in Los Angeles.

**Kenneth K. Krausche** has been appointed technical advisor for agricultural chemicals department of Pennsylvania Salt Mfg. Co., Philadelphia.

## OBITUARIES

**John N. Houser**, 67, vice president and general manager of Tennessee Copper Co., Copperhill, Tenn., died in Knoxville, Tenn., November 1.

**Albert A. Criqui**, 67, consulting engineer for the Buffalo Forge Co., Buffalo, N. Y., died November 7.

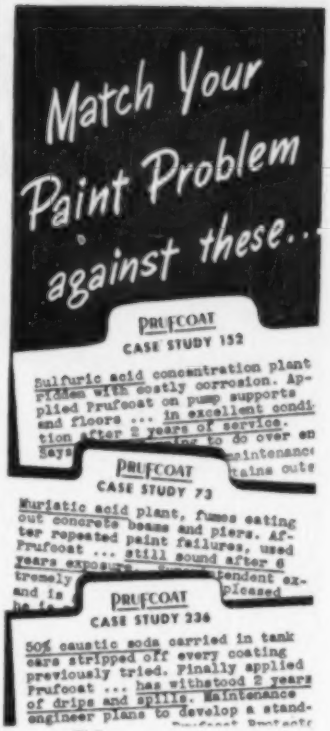
**Francis James Hood**, 44, president of Ansul Chemical Co., Marinette, Wis., died in New York, N. Y., November 10.

**Edward Grasselli**, 62, grandson of Eugene Grasselli who founded the Grasselli Chemical Co., died in Cleveland November 16.

**Carter Stanard Cole**, assistant technical secretary of the American Society for Testing Materials, died in Philadelphia on November 17.

**Bernard R. Armour**, 58, president and director of American Aniline Products, Inc. and Heyden Chemical Corp., died in New York, N. Y., December 1.

**Charles R. Moulton**, 65, assistant director, patent division, Argonne National Laboratories, Chicago, died December 4.


Yes, in plant after plant, for over ten years now, Prufcoat has been stopping profit-eating corrosion and cutting painting maintenance costs—*on machinery, equipment, pipes, ducts, tanks, floors, walls, ceilings.*

**GET PROOF BEFORE YOU BUY**

Send today for a *Prufcoat Proof Packet.* Contains outside laboratory tests, case histories, and Prufcoat Protectograph Plan for analysing your own painting maintenance costs.

Write PRUFCOAT LABORATORIES, Inc.
63 Main Street, Cambridge, Mass.

*SAVES More because it PROTECTS More*

EIGHT Attractive Colors

# 1950

## Can Be The Year You Saved Most In Process Production!

BUFLOVAK Equipment leads to economical and profitable Chemical and Food Processing. By maintaining high product quality at low production cost, BUFLOVAK assures you real savings.

Illustrated are some of the BUFLOVAK equipment. The complete line includes Dryers, Evaporators and Processing Equipment for foods and chemicals. Savings are reported by users in plants everywhere. It's advanced engineering plus modernized construction that does the trick. By using BUFLOVAK you, too, can fatten the piggy-bank of profits.

Complete information is available on all the units shown here. We invite you to write today for full data and learn the many exclusive features offered you by BUFLOVAK.

Let us tell you also about our complete and up-to-date Research and Testing Laboratories that can study your processing problems and tell you the complete results of your contemplated process before you begin actual operation.

**BUFLOVAK EQUIPMENT**

*Division of Blaw-Knox Co.*

**1551 FILLMORE AVE. BUFFALO 11, N. Y.**

*Engineered*

RUBBER INSULATED EQUIPMENT FOR HANDLING CORROSIVES

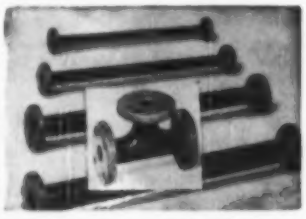
**PROCESSING TANKS**

Any size, any shape, open or closed, fabricated and/or rubber lined for all chemical processing.

WRITE FOR OUR CATALOG ON THE COMPLETE LINE.

**EXHAUST SYSTEMS**

Ducts, vents, hoods, housings, fabricated and/or rubber lined. All joints companion flanged.



**PIPE and FITTINGS**

Flanged type, lined with natural or synthetic rubber. Steel, cast or wrought iron. 1½" I.D. and up.

AUTOMOTIVE RUBBER CO. INC
8601 EPWORTH BOULEVARD
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# *INDUSTRIAL NOTES*

## NEW FACILITIES

**Lewis Flight Propulsion Laboratory**, Cleveland, Ohio—a building for high energy fuel research. It will house four test cells, twelve chemical and physical laboratories, shops and utility rooms. A portion of the building will house equipment for the synthesis of high energy propellent fuels.

**National Tube Co.**, Lorain, Ohio—new steel and pipemaking mills. They'll make small size seamless pipe products ranging from 2 to 4½ in. in diameter.

**Hilton-Davis Chemical Co.** division of Sterling Drug Inc., Langdon Farm Rd., Cincinnati—a newly enlarged dyestuff laboratory.

**Texas Co.**, Beacon, N. Y.—a centralized department for standardizing laboratory equipment. It will serve 20 refinery and 17 terminal laboratories throughout the world. The department is also responsible for the initiation of new and improved test methods.

**Hyster Co.**, Portland, Ore.—an industrial truck retail sales and service building at 4445 Third St., San Francisco.

**Horace T. Potts Co.**, Baltimore—a steel warehouse at 2835 Sisson St.

**Consolidated Western Steel Corp.**, Los Angeles—installations at Orange, Tex., for the production of steel plate products, fabricated pipe work, general machine shop work and other plate products. The company plans to add to these facilities which were bought from the government.

**Sprout, Waldron & Co.**, Muncy, Pa.—a subsidiary to serve the Pacific Coast and Rocky Mountain states. Its offices are at 2554 West St., Oakland, Calif.

**Abbott Laboratories**, North Chicago, Ill.—a branch office and warehouse building at 1601 Dana Ave., Cincinnati, Ohio.

**Commercial Solvents Corp.**, New York—a fermentation and filtration unit with all necessary equipment for large-scale antibiotic production. The unit is to be installed in the company's Terre Haute, Ind., plant.

**American Cyanamid Co.'s** industrial chemicals division—installations at their Kalamazoo, Mich., plant for producing carburizing and heat-treating compounds. Cyanamid will continue to manufacture some of these compounds at their Warners plant in Linden, N. J.

**Best Effect Chemical Co.**, Hackensack, N. J.—a laboratory wing for developing and producing a new line of glandular products recently placed on the market.

**Guy B. Panero**, Engineers, of New York—a Washington, D. C., branch office headed by Walter L. Rubel. The office will be at 1406 "G" St.

**Chas Pfizer & Co.**, Brooklyn, N. Y.—a plant in Groton, Conn., for the manufacture of fine chemicals by organic synthesis.

**Ohio Adhesives Corp.**, New Philadelphia, Ohio—a resin and rubber adhesive plant at New Philadelphia.

## NEW COMPANIES

**Reichhold Chemicals (Canada) Ltd.**, Toronto, to provide Canadian paint manufacturers with a complete line of synthetic resins. The new company, an affiliate of Reichhold Chemicals, Inc., Detroit, has purchased the unfinished resin manufacturing plant of Canadian Alkyd Industries Ltd. at Weston, a Toronto suburb.

**Brunswick Chemical Co.**, Brunswick, Ga., to produce insecticides. Robert Flick is manager.

**Southern Latex Corp.**, Austell, Ga., to operate the first liquid rubber latex processing distributing plant in the South. Doug C. Cochran is president.

## NEW LINES

**National Aluminate Corp.**, Chicago, has entered the catalyst field on a commercial scale and has formed a catalyst division. They are already producing ground silica-alumina catalyst and plan more refinements in grading and sizing to satisfy a wider range of specifications.

**Aerovox Corp.**, New Bedford, Mass., now produces a complete line of fixed capacitators as a result of their

(*Continued*)

# 15 points where chemical plants get STAINLESS TUBING SATISFACTION

## SEAMLESS & WELDED TYPES for ALL needs including:

- Croloy 18-8 Hi Carbon (Type 302)
- Croloy 18-8 Si (Type 302B Mod.)
- Croloy 17-8 FM (Type 303 Mod.)
- Croloy 18-8 S (Type 304)
- Croloy 20-10 (Type 308)
- Croloy 25-12 (Type 309S)
- Croloy 25-12 Cb (Type 309S Cb)
- Croloy 25-20 (Type 310)
- Croloy 16-13-3 (Type 316)
- Croloy 16-13-3 Cb (Type 316 Cb)
- Croloy 18-13-3 (Type 317)
- Croloy 18-8 Ti (Type 321)
- Croloy 12 Al (Type 405)
- Croloy 12 (Type 410)
- Croloy 12-2 (Type 414)
- Croloy 13 (Type 420)
- Croloy 18 (Type 430)
- Croloy 22 (Type 443)
- Croloy 27 (Type 446)

In addition to B&W Tube Co. offices listed here, jobbers and distributors stock B&W Tubular Products . . . grades, sizes and gauges for all pressure and mechanical needs. Write for name of distributor nearest you.

THE BABCOCK & WILCOX TUBE COMPANY
GENERAL OFFICES: BEAVER FALLS, PA.
PLANTS: BEAVER FALLS, PA.
AND ALLIANCE, OHIO

B&W SEAMLESS and WELDED TUBES

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3. BOSTON 16, MASS.
   Garden Building
   290 Boylston Street
   Copley 7-0037
4. CHICAGO 3, ILL.
   Borland Building
   105 South LaSalle Street
   Central 6-6546
   TWX No. CG 1017
5. CLEVELAND 14, O.
   National City Bank Bldg.
   629 Euclid Avenue
   Main 3984
   TWX No. CV 477
6. DENVER 2, COLO.
   Albany Hotel Bldg.
   1728 Stout St.
   Acoma 3371
7. DETROIT 26, MICH.
   820 Ford Building
   615 Griswold Street
   Woodward 1-0360
   TWX No. DE 57
8. HOUSTON 2, TEX.
   Bankers Mortgage Building
   709 Main Street
   Capitol 9074
   TWX No. HO 124
9. LOS ANGELES 15, CALIF.
   Petroleum Building
   714 Olympic Boulevard
   Prospect 3069
   TWX No. LA 943
10. NEW YORK 16, N. Y.
    22 East 40th Street
    Murray Hill 9-6212
    TWX No. NY 1-1389
11. PHILADELPHIA 2, PA.
    Packard Building
    Fifteenth & Chesnut Streets
    Locust 4-0522
    TWX No. PH 92
12. SAN FRANCISCO 3, CALIF.
    Humboldt Bank Building
    785 Market Street
    Yukon 6-5911
13. ST. LOUIS 1, MO.
    Paul Brown Building
    818 Olive Street
    Central 5624
14. SYRACUSE 2, N. Y.
    State Tower Building
    109 S. Warren Street
    Syracuse 3-2566
15. TULSA 3, OKLA.
    Philtower Building
    427 Boston Street
    Tulsa 2-0298
    TWX No. TU 82

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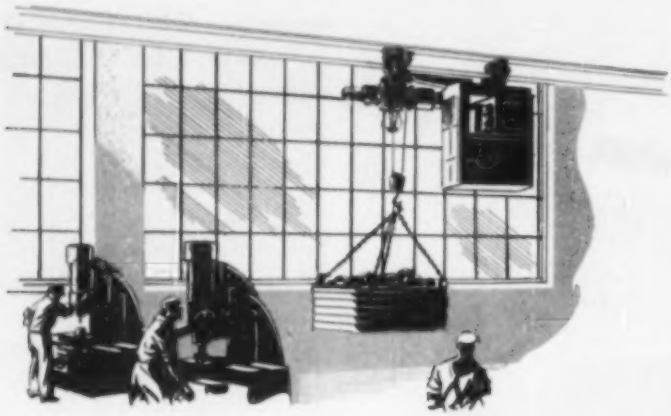

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## *use dependable thru-the-air handling*

KEEP in mind these important advantages which "through-the-air" handling alone gives you. Unrestricted use of floor space, accurate spotting of work, higher stacking, greater dependability and safety, lower upkeep and longer life. On the production line or when storing or warehousing, they add up to worthwhile savings.

For a great many years, we have devoted our entire facilities to the manufacture of cab-operated and floor-controlled hoists, and overhead traveling cranes—and to laying out plant systems to make them the most efficient of all lifting and conveying tools.

May we show you pertinent data on installations similar to yours?

**Shepard Niles**

CRANE & HOIST CORPORATION

Makes and sells all three lifting tools for airborne shop loads

CRANES • Overhead

HOISTS • Cab Operated

HOISTS • Floor Operated

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INDUSTRIAL NOTES, *cont. . .*

purchase of Electrical Reactance Co. Electrical Reactance, which manufactures ceramic capicators, has become a wholly-owned subsidiary under the continuing management of Charles E. Kramph as president.

**Perry Metal Products Co.**, Brooklyn, N. Y., has extended activities in the pharmaceuticals and chemicals fields. They have formed a pharmaceutical division to handle packaging, filling and labeling for those industries.

**Olin Industries, Inc.**, East Alton, Ill., has purchased the Ecusta Paper Corp., Pisgah Forest, N. C., and will begin the manufacture of cellophane there.

**Laclede-Christy Co.**, St. Louis, Mo., has acquired the Diamond Fire Brick Co., Canon City, Colo., which produces fire clay brick and silica brick.

**Minneapolis-Honeywell Regulator Co.**, has acquired a Belfield valve division. The valves will be promoted and sold through all the Honeywell branch offices.

**Beaumont Birch Co.**, Philadelphia, has enlarged its line of coal, coke and ash handling equipment. It has enlarged its services in the hydraulic materials handling equipment lines. H. R. Pursel has been named head of the hydraulic materials handling systems department.

**Dewatex Mfg. Corp.**, New York, has formed an Asphalt-Seal division to take over sales and distribution of its newly developed product of that name.

**City Chemical Corp.**, New York, has begun production of a number of special research chemicals for industry.

**Nopco Chemical Co.**, Harrison, N. J., has been licensed by Philips Laboratories, Inc., to manufacture vitamin $D_2$.

**H-B Instrument Co.**, Philadelphia, has acquired the thermometer lines formerly manufactured by the American Thermometer Co., St. Louis, Mo., as a result of its purchase of that company.

**S. P. Kinney Engineers, Inc.**, Pittsburgh, Pa., has equipped a plant in Carnegie, Pa., to manufacture blast furnace equipment. Primary and

combined primary and secondary gas washers for blast furnace and other gases, and self-cleaning and basket water strainers are among the equipment that will be manufactured.

**Fine Organics, Inc.**, New York, N. Y., has entered the commercial air transportation field as a supplier of fine chemical products for aircraft maintenance, overhaul and operation.

### NEW REPRESENTATIVES

**Chromalox**, Pittsburgh, Pa., has made Leo C. Pelkus & Co. its Boston representative.

**Hyster Co.**, Portland, Ore., has appointed three distributors for its materials handling equipment: A. & W. Engineering Co., Miami, in southern Florida; Wrenn Brothers, Charlotte, N. C., in South Carolina, southern North Carolina and most of Georgia; King and Kringel Machinery Corp., Denver, in most Wyoming and western Nebraska.

**Gamma Chemical Corp.**, Newark, has appointed Fisher Chemical Co., New York, exclusive sales agents for its fine organic chemicals.

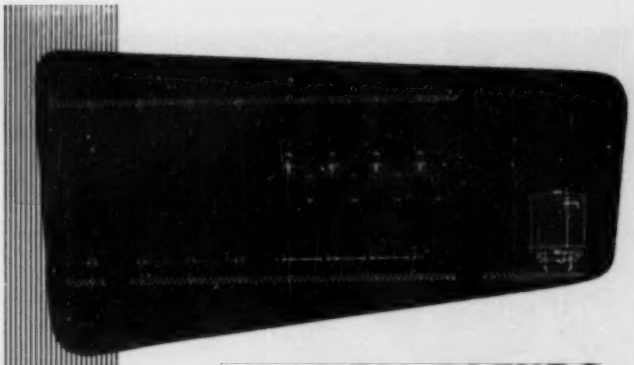
**National Engineering Co.**, Chicago, Ill., has appointed the Jack-Stiehl Co., Berkeley, Calif., as distributors for its line of mixers and materials handling equipment.

**Dampney Co.** of America, Boston, has appointed Industries Service & Equipment Co., Erie, Pa., its representative in Erie, Crawford and Warren counties in Pennsylvania.

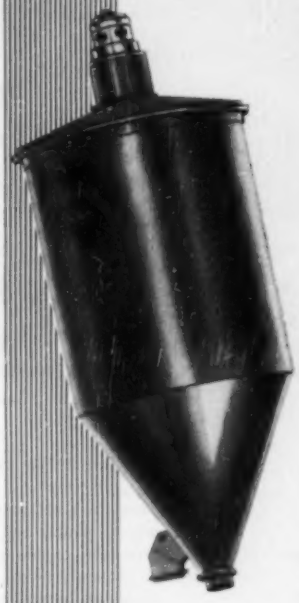
**Kold-Hold Mfg. Co.**, Lansing, Mich., Platecoil division, has appointed the following representatives in the East: Paul B. Huyette Co., Philadelphia; H. R. Houghton Co., Baltimore; W. B. Parsons Co., Boston; Gerald B. Duff Co., Newark. In the Midwest they have appointed: Henry P. Thompson Co., Cincinnati; Power Plant Efficiency Co., Indianapolis; Patton Equipment Co., St. Louis; W. P. Nevins Co., Chicago.

**New England Starch Co.** has appointed Morningstar, Nicol, Inc., New York, as sales agents for its Houlton and Mars Hill, Maine, factories.

**De Laval Steam Turbine Co.**, Trenton, N. J., has appointed Superheater Co., Ltd., to represent it in Canada. —*End*

**UNIFORM BLENDS By the Carload!**



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# Quotes, Extracts and Digests

MORGAN M. HOOVER, Assistant Editor

## ODOR CLASSIFICATION

### Is it possible without a valid theory of odor?

### "No!"—Edward Sagarin

Classification is here considered in a qualitative sense, as it applies to odor. We are not evaluating the validity of quantitative odor classification, nor do we consider affective classifications based on an odor stimulus.

By odor classification, we mean the grouping together of different odorous substances or stimuli according to a qualitative similarity or affinity among them.

In denying the validity of current systems of odor classification, or in fact the possibilities of creating such systems at this stage of our knowledge, we do not by any stretch of the imagination deny the desirability of odor classification.

If the value of classification has been stressed by philosophers of science, it has been assigned equal importance by workers in the field of odor. But if the chemist has expressed the importance of odor classification, he has not failed from time to time to underline the futility of attempting such a classification at this stage of our knowledge.

Any scientific system, whether or not it deals with classification, must be objective in order to be valid, and objectivity involves reproductibility.

Now, how is it possible to determine that an observation has the objective value which concededly must be the basis of classification? How can this objectivity be established when the observation is one based exclusively on a subjective sensory impression? There is no contradiction here, for the objectivity is deduced through the verification of results so that the relationship is established in the minds of so many normal human beings that it can be said to exist in the nature of the things being observed.

It is not in unverified personal observations, but in the observations of all normal human beings that a scientific concept is based. No system of classification has validity unless it is verifiable and reproducible, by the same individuals and by others, and that an effort at classification in any field of knowledge based exclusively on perceptions and observations that inevitably vary with the individual observer must be inherently invalid.

Efforts to classify odors into qualitative groups are as old as the history of the literature of perfumery. Many attempts have been made to create odor classification systems in the years that have followed. The number of such systems is great, but they roughly divide themselves into two main groups: the systems in which several odors were brought together and simultaneously placed in a single group; and those in which a single odor was simultaneously placed, to a smaller or greater extent, in several groups.

To cite an example of the former method, Zwaardemaker divided all odors into nine categories. Within each there could be examples or subdivisions. No two workers who have studied this question independently have ever arrived at the same or similar results. The

(Continued on page 238)

### "Yes!"—E. C. Crocker

Both of us agree on many points. To save time, we can state that we both see the great desirability of odor classification provided it can be done on a sound basis, and we are both talking about qualitative characterization and not about thresholds of intensity or other matters of strength or quantity of odor such as may be measured by an osmoscope. We agree on the existence of what the psychologist calls "pure odor," as against odor sensations which involve trigeminal sensations including those of pain, which is called "pungency," and of coolness, warmth and contact. We further agree that no present theory of odor or smelling is soundly enough established to be the basis of a system of odor classification. What we disagree on is the possibility of obtaining a workable system of odor classification in the absence of a valid theory of odor.

From the standpoint of logic, it is desirable to have a firm foundation before we build a structure of any kind, on the analogy that without sound premises we cannot arrive at valid conclusions.

Sometimes, pure assumptions are first made and tested, and if the findings are correct, then something of the nature of the underlying laws and facts can be discovered. Again, some physical facts, such as gravitation, matter, electricity, and magnetism, are so difficult to understand that we can treat them only as mathematical concepts until enough of their properties have been observed that we can adjust our minds to conceive of them as real, even though incomprehensible to our senses.

We do not know anything finally, completely, or fully, yet we do fairly well in utilizing matter, energy, and the associated radiations. Sometimes, using even a wrong hypothesis, we are led to an approach close enough to the underlying truth that with a few more attempts we find it. Columbus had the wrong idea about where he was going, but the result of his voyage was most useful to geography and the world. The point was that he did something, and didn't just conclude that until detailed maps were in existence it would be of no use to go on a long sea trip. A system of odor classification which does not depend upon any special theory of odor may not only be useful in itself, but may even lead to the discovery of the nature of odor and smelling.

Odor sensations are carried to the brain by means of a nerve system, from the odor-detecting area located high in the nasal chamber. We can conceive of two broad patterns of complexity of nerve-bundles for the conveying of the odor message: one, with a nerve or group of nerves responsive to and capable of conveying each separate sensation, whenever stimulated, and the other, with only a relatively few kinds of nerves, and these used in permutations and combinations to convey information about the presence of any kind of odor detected.

The so-called "principle of parsimony," which applies to all of the other activities of the human body, does not

(Continued on page 239)

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**NO!**

(*Continued from p. 237*)

history of odor classifications of this type indisputably demonstrates an utter lack of reproductibility so far as numbers of classes, names of classes, and the placing of individual odors within the classes are concerned. The mere fact that every worker attracted to odor classification had to reject all previous systems, had to work out a system according to his own smelling abilities, and that this system was destined to be rejected by all those coming after him, demonstrates the lack of consensus which is considered essential to scientific validity.

Let us now turn attention to the second group of classification systems, of which the earliest important example was the Henning prism.

Henning conceived of odor as being representable by a prism, at the six points of which were located the six qualities or classes of odors, namely flowery, fragrant or ethereal, resinous, spicy, burned, and putrid. By placing an odor at a given point on the surface of the prism, and at a given distance from the six corners, it was usually possible to indicate the extent to which an odor fell into one or several classes. Thus, Henning conceived of odor classification in terms of likeness and of degrees of likeness.

The Henning system was put to the test of verification by several psychologists, and their results are most illuminating.

The work of several of them came under the scrutiny of Gamble, who summarized this work as follows: "Dimmick . . . prejudiced his investigation in Henning's favor . . . Macdonald concluded 'that his findings correspond with Henning's only to an extent which might be indicated by a product-moments correlation between .30 and .40.' Findley, in spite of concessions to Henning, found as little evidence for the prism as did Macdonald, and both Findley and Macdonald stress the inconsistency of their results."

The last major effort at odor classification, utilizing a system based on degrees of likeness within a qualitative differentiation, was that of Crocker and Henderson. These scientists reduced the number of odor classes to four. The degree to which an odorous stimulus is fragrant is expressed by a number ranging from zero to eight, the former meaning that it has none of the fragrant quality, and the latter the maximum.

The Crocker-Henderson system is an improved and simplified Henning prism. The substitution of a numerical for a geometrical method of expression is a major simplification, and constitutes an improvement in the sense that the results are more easily communicated, but is a device rather than a new system.

Is the Crocker-Henderson system capable of being verified? The experience with the Henning system would indicate that, by its very nature, this system likewise must produce inconsistent results.

Henning and Crocker-Henderson are the sole systems which have been put to the test of verification, and both have failed that test. Although the psychologists who have evaluated these works have found the systems unproved, their cumulative evidence has a greater significance, and that is that it proves experimentally that, at this stage of our knowledge and until further data are forthcoming the same materials will not be classified qualitatively as far as odor is concerned by different observers in the same or similar manner.

A valid system is unattainable in odor classification, so long as it is based exclusively or sensory impressions of individuals. The logic leading to that conclusion is simple. All experimental work on classification demonstrates that the only consistency is the lack of consistency; all that is predictable is the lack of ability to predict, from which a deduction is justifiable that, at this stage of our knowledge, consistency is unattainable. Consistency is a prerequisite for validity, and therefore validity is itself unattainable, or the systems are inherently invalid.

If each person establishes his own odor groups, and results are not reproducible, and is reproducibility is a prerequisite for scientific validity, shall we conclude that odor classification is impossible? We would say that, at the present state of our knowledge, there is an inherent invalidity because all systems will prove as irreproducible as those that have already been tested.

The sole hope for odor classification is the establishment of a sound and proved theory of odor, which will establish the nature of the olfactory stimulation, and perhaps indicate that there is an affinity of some sort among certain stimuli which differentiates them from all others.

Edward Sagarin, Givaudan-Delawanna, Inc., before the Society of Cosmetic Chemists, New York, Dec. 8, 1949.

**WHEATIES?**

**"Today approximately one-half of all the energy Americans use comes from petroleum and natural gas."**

**S. A. Swensrud**, *President*
***Gulf Oil Corp.***

**YES!**

(*Continued from p. 237*)

permit great numbers of parts to stand by idle most of the time, to be used only on occasion. With this principle in mind, we are forced to conclude that odor impression transmission practically must take place over a comparatively limited network of kinds of nerves, frequently used. This is a way of saying that components of some sort must exist in odor sensation, and that it should be possible to classify odors by a method based on these components.

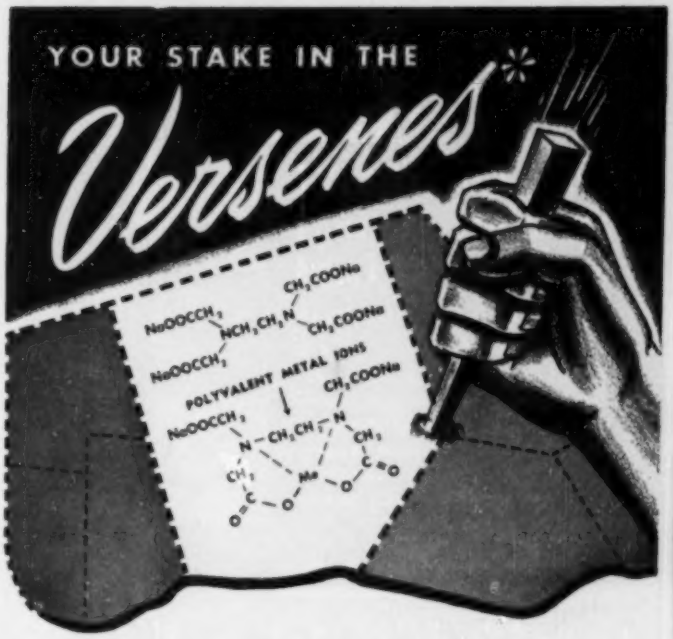
The Crocker-Henderson system of odor classification was devised some 23 years ago, and has had considerable publicity. We shall consider it alone, although we recognize that other systems are conceivable. It was developed by cut-and-try, working with actual odor sensations, to find components if they exist, keeping the principle of parsimony definitely in mind. In its present form, it recognizes only four basic types of odor sensation as applying to the human nose—fragrance, acidity, burntness and caprylicness. It expresses all pure odor sensations as composed of these four component sensations, denoting the relative intensities of each by single digits, arranged in a particular sequence: that based on general human interest. The digits ordinarily used are 1 to 8, but conceivably 0 to 9 can be so used, for extreme cases. Each of the four sensation components is considered capable of appreciation independently of the others. The sense of smell is supposed to be analytical enough and critical enough that we can concentrate on these components one at a time. Some workers are able to analyze their sensations very well, but apparently all can do so with some facility.

Physically, this system uses a set of 32 standard substances which have been selected as being reasonably stable against changes with time, and harmless and non-tiring, one for each originally-recognized degree of differentiation for each of the four components.

With such a set of odor component standards, any odor sensation may be "odor-numbered" by direct comparison with the standards, one component at a time, to obtain a four-digit number which is the code number for that sensation. By this means and using only whole numbers, some 4,096 separate sensations may be differentiated and expressed, not nearly enough to cover all known odors, but a usefully-sizable group.

With the limitations and possibilities in mind, how closely can the

(*Continued*)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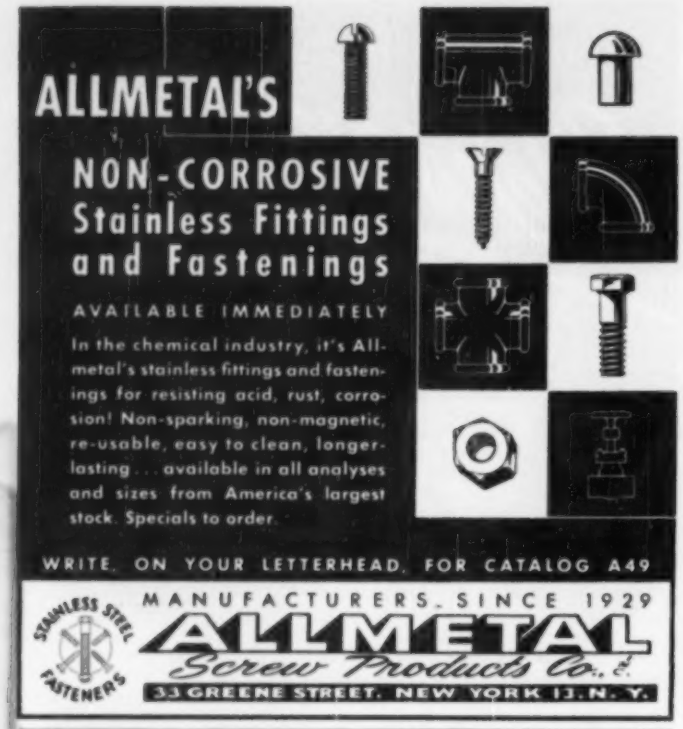
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QED, *cont. . .*

Crocker-Henderson system define single pure odors, how well do people check each others' findings, and how much training is needed to use the system effectively? A test was run in our flavor laboratory recently, unknown to me and in my absence, to answer all of these questions at one time. The findings obtained may be of general interest. Four of the observers tested were trained flavor workers and had used the Crocker-Henderson system before, at least occasionally, but the other four were persons who were odor numbering for the first time. Each observer was tested on eight assorted substances.

We obtained answers, first that single observers cannot do better than reach the nearest unit, second that people check each other with a variance of about 1 unit, and third that there is about a 20 percent gain in accuracy through considerable experience with the system.

Study of these findings indicates several ways in which the system might be improved. Probably some standards, and especially the caprylic standards, can be replaced by others more accurate or else easier to use. A careful search may find many better-adapted substances, but replacements will need to be checked by a relatively large number of workers—not just two, as in the past, no matter how experienced they might be.

This system of odor classification is primarily useful as a training device for beginners in odor. It teaches them to concentrate and to analyze their sensations. Sometimes, it provides alternatives for particular odorants. In any event, by the time we have determined the odor number of a substance, we already have become reasonably familiar with its odor and have compared it with other odors. If an odor-detecting machine is developed which had good inherent discrimination, it will be of very great interest to compare its findings with those of this system, particularly to find out what the machine misses of what we smell, and vice-versa. For the present, we suggest that use be made of this admittedly imperfect tool. Contributions by others to improve the system are solicited and will be welcome. It suggests certain things

JACKPOT COMING?

"Antibiotic research is very much like playing a slot machine, where each new antibiotic at the discovery stage represents a coin."

R. D. Cochill, *Director of Research*
*Abbott Laboratories*

that are possibly inherent in odor, hence should be useful in the search for the truth about odor. It is intended to be a light in comparative darkness—a weak light perhaps, and flickering—but at least, a light.

Ernest C. Crocker, Arthur D. Little, Inc., before the Society of Cosmetic Chemists, New York, Dec. 8, 1949.

## OIL

### . . . *Shale Facts*

*H. M. Thorne, et al.*

Low-cost mining of oil shale by underground quarrying has been essentially proved by United States Bureau of Mines experiments. Oil shale offers a major potential source of liquid fuels in the United States to help offset the wartime depletion of the nation's petroleum reserves. Current estimates place the oil content of shale in the vast Green River formation of Colorado, Utah and Wyoming at 300 billion barrels—about a 150-year supply at the present rate of consumption.

Aside from fuel, shale oil can yield such important byproducts as paraffin wax, asphalt for paving, compounds useful as wood preservatives and in the manufacture of plastics and pharmaceuticals.

Oil shale deposits occur in every continent of the world, and many of the deposits have been and are now being worked for the production of fuels and other petroleum substitute products. In fact, the United States, along with England, France, and Canada, was producing oil from shale before the first American petroleum well was drilled near Titusville, Pa., in 1859.

American operations soon succumbed to the competition from petroleum, but operations in Scotland and France have been continuous. Industrial oil-shale plants are now operating in Scotland, Sweden, France, Estonia, Spain, Australia, the Union of South Africa, and possibly in Russia and Manchuria. During the last war the Japanese-controlled Manchurian plants produced one and one-third million barrels of fuels a year, used principally by the Japanese Navy.

American interest in shale oil was revived during World War II when unprecedented demands slashed the nation's petroleum stocks. As a result, oil shale is now being studied on a research and development scale at Laramie, and on a demonstration-plant scale at the Bureau of Mines Oil Shale Mine and Plant near Rifle, Colo.

The Green River formation is the

(Continued)


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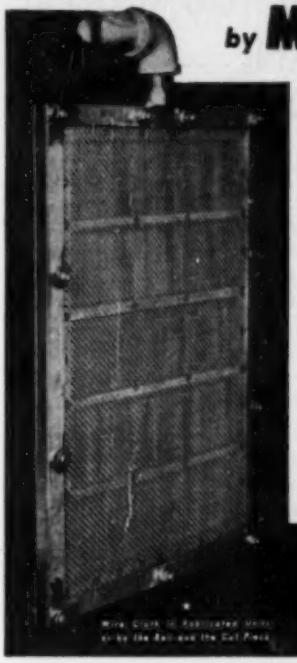

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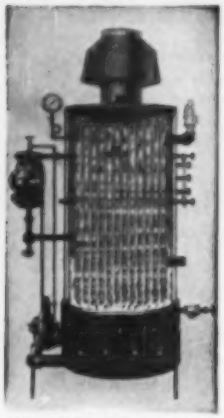

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QED, cont. . .

world's largest shale-oil reserve, spread over an area of about 16,500 sq. mi. Summing up approximately 8,000 assays which have been made in Green River formation, it is estimated that a persistent oil shale bed known as the Mahogany Ledge, approximately 80 ft. thick and assaying 30 gal. of oil per ton, contains 100 million barrels of oil per square mile, or approximately 100 billion barrels for the 1,000 sq. mi. of this bed.

Based upon present information, it is estimated that Green River oil shales in Colorado, Utah, and Wyoming, which assay 15 gal. or more of oil per ton of shale, contain 300 billion barrels of oil, nine-tenths of which are in Colorado.

Oil shales are a variety of fine-grained sedimentary rocks containing organic materials which is only slightly soluble in petroleum solvents but is largely converted to oil by the application of heat.

The production of shale oil involves two essential steps in addition to mining and transportation of shale to the processing units: the conversion of the solid organic material to a liquid or semi-liquid, and separation of this conversion product from the inorganic residue.

Many of the essential engineering factors required for converting the organic material (kerogen) in the shale to oil, as heat of retorting, heat contents of shales, and reaction rates, have been established. Several retorting processes of merit are under development by the bureau of mines and industry.

H. M. Thorne, W. I. R. Murphy, J. S. Ball, K. E Stanfield and J. W. Horne, U. S. Bureau of Mines, before the American Chemical Society, Oklahoma City, Dec. 9, 1949.

## LEGAL

### . . . *Licensing*

*John M. Weiss*

Every state, territory and even the District of Columbia has laws regulating the practice of engineering. Such laws have been in effect in New York for more than 20 years.

In New York, for example, civil service positions involving engineering practice can be filled only by

**LET IT RAIN**

**"Tetra alkyl orthotitanates have been found highly effective as waterproofing agents for almost all materials."**

R. J. Speer and D. R. Carmody
*Texas Research Foundation*

licensed engineers. Civil courts will not hear expert testimony on engineering matters unless the witness is a registered and licensed engineer.

Should an unlicensed engineer take court action to recover fees for professional service, his cause would be dismissed without a hearing. Unauthorized use of the term "engineer" in telephone directories or in advertising material can be prosecuted in courts.

Many employers are requiring certain members of their engineering staffs to apply for licenses. If, for example, a fatal accident should occur through a faulty engineering design, an unregistered man who made such faulty design could be prosecuted for manslaughter, whereas a registered engineer under the same circumstances is merely guilty of an error in professional judgment. The various manifestations of professional recognition of engineers are individually small, but the results are cumulative and steadily increasing.

John M. Weiss, John M. Weiss and Co., before the American Institute of Chemical Engineers, Pittsburgh, Dec. 4, 1949.

## CONVEYOR BELTS

### . . . *New Possibilities*

*Harold von Thaden*

In recent years, there has been talk of the possible dwindling of the mighty Mesabi Range's supply of iron ore. Against that day, two other sources of supply have been investigated. In both plans the belt conveyor figures heavily. Should the utilization of low-grade taconite ore be developed, the only feasible means of handling the vast quantities of ore needed is the belt conveyor. Should ore supplies in Labrador, Morocco, and South America be developed further, again the belt conveyor would be indispensable, for in these countries present transportation systems are negligible.

In Labrador, for example, a belt conveyor system could feed ore to the projected railroad. It could carry certain materials over terrain where no railroad could operate. Conveying systems can make it possible to operate railroads profitably. The same situation applies in Africa and South America. The belt conveyor may well be the ultimate means for these relatively undeveloped areas to become the prosperous suppliers of raw materials to the world.

If the iron ore deposits are fully developed in these foreign countries, I believe another basic change could take place. Iron ore pouring into the

(*Continued*)

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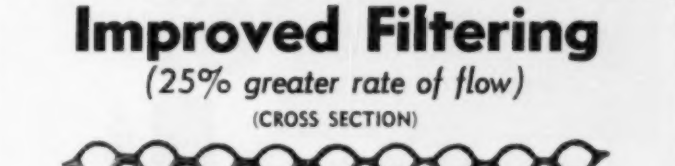
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QED, *cont. . .*

East Coast by freighters, may in time create steel centers along the coast that would well rival the Pittsburgh-Chicago axis.

The movement of both people and vehicles through the streets of our large cities is rapidly becoming a problem in materials handling. I believe the time has arrived when the civic development commissions of our great cities should have on their staffs a materials handling engineer, who can look at the handling of people as they move about a city as he looks at the handling of products as they are transported about a plant. His experience in the study of the flow of materials could solve many of our current traffic problems.

Harold von Thaden, Hewitt-Robins Inc., before the American Society of Mechanical Engineers, New York, Dec. 1, 1949.

## NATURAL GAS

### . . . *Invading Oil*

*E. Holley Poe*

The competition with light oils from natural gas will grow, rather than diminish, as natural gas extends its area of service. To the extent that natural gas brings about a decrease in demand for lighter oils, refinery and production processes may have to be altered. Profit possibilities in natural gas do not rely on low field prices. The going field price has doubled in the past decade, but expansion has accelerated with the increases.

Increases in the energy requirements of the United States for 1939 and 1948 are: anthracite coal, 11 percent; bituminous coal, 50 percent; petroleum, 66 percent; natural gas, 97 percent; and water power, 77 percent.

Both coal and oil have increased in proportion to the whole; anthracite and bituminous coal have declined. At present oil and gas supply is about half of the nation's total energy requirements.

Natural-gas reserves are adequate, and are increasing at a rate faster than withdrawals. In 1948 net withdrawal was in excess of 6 trillion cubic feet, but reserves increased by 15 trillion cubic feet. In 1947 60 percent of national kesosene sales were in the New England and central Atlantic area. This area has been consuming gas at a rate per customer of less than one-fifth of the national average where natural gas is used. Prices will be a factor; but, with natural gas, much of this oil load will be lost to gas.

More than 45 percent of all oil-burning house-heating installations in the United States are in New York,

New Jersey, and the New England states. Gas at 8 c. per therm is equal, in effective delivered heat, to No. 2 fuel oil at 11.2 c. per gal., or anthracite coal at $20 a ton; 8 c. is a reasonable natural-gas rate for house heating.

The last market in which oil can expect competition from natural gas is in the residual-oil market. Natural gas is now regarded as too superior a fuel for boiler use, except as a load-balancing factor. Spectacular developments have been made in the manufacture of high-Btu oil gas; 70 or more such installations are in use, and the number is growing. It is conceivable, dependent upon oil prices, that high-Btu. oil gas may be made in many sections of the country at a cost less than the laid-down cost of natural gas. The entire history of the petroleum industry has been one of adjustment to change. No doubt these changes are already being made.

E. Holley Poe, E. Holley Poe and Associates, before the American Petroleum Institute, Chicago, Nov. 7, 1949.

## PERSONAL

### . . *Ammoniated Dentrifices*

*R. G. Kesel*

A study of caries-resistant people revealed that ammonia developed in their saliva upon incubation at a more rapid rate than it did in saliva obtained from caries-susceptible subjects. It was found that ammonia nitrogen has an inhibiting effect on Lactobacillus acidophilus and certain other acidogenic bacteria. The *in vitro* presence of 0.5 milligram of ammonia nitrogen per milliliter completely checked the growth of these microorganisms.

Various ammonium salts were tested for their effectiveness in inactivating lactobacilli and it was found that dibasic ammonium phosphate was the most practical for clinical use. It was also learned that when urea was combined with di-ammonium phosphate the antibacterial action was increased and the degradation of glucose to lactic acid was prevented.

Dibasic ammonium phosphate and urea were then applied to teeth in a clinical study to determine if they might have a similar action in the

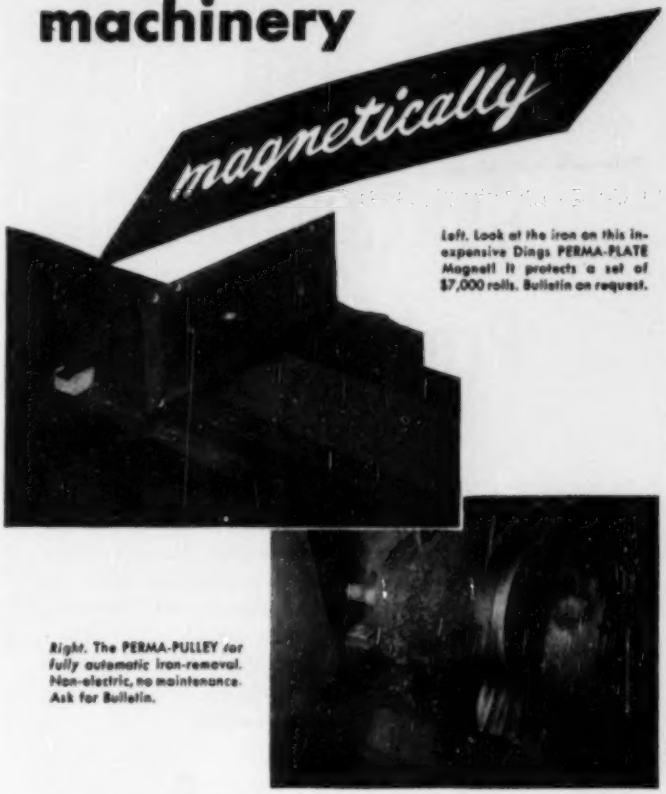
(Continued)

THEY'RE NOT SURE

"Until the carefully controlled clinical experiments, now in progress, are completed, the use of ammonium salts to control dental caries is experimental."

THOMAS J. HILL, *Chairman*
*Council on Dental Therapy*
*American Dental Association*


# How to guard machinery magnetically



Left. Look at the iron on this inexpensive Dings PERMA-PLATE Magnetl It protects a set of $7,000 rolls. Bulletin on request.

Right. The PERMA-PULLEY for fully automatic iron-removal. Non-electric, no maintenance. Ask for Bulletin.

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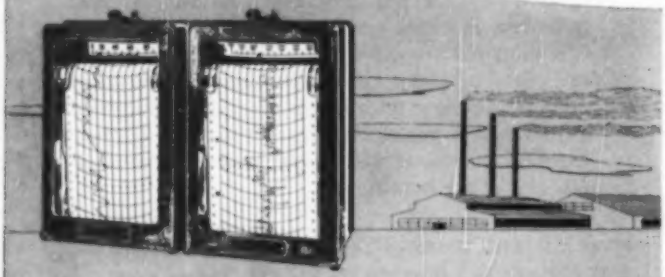

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mouth and if ultimately their use would show reduced caries activity. An antibacterial agent for use in the oral cavity should have a more or less specific action—in other words, it should inactivate the bacteria associated with the disease to be treated by it without interfering with the rest of the oral bacterial population. In that way it could have a prolonged, indirect effect through the encouragement of a bacterial flora antagonistic to the disease producing one.

In vitro studies suggested a concentration of 5 percent di-ammonium phosphate and 3 percent urea as desirable for this purpose. This combination used consistently in a dentifrice and mouth wash produced a marked reduction in the oral lactobacilli.

Preliminary clinical studies indicated a reduction in caries activity and a large scale project is now under way to determine the actual value of these agents in these proportions for reducing tooth decay in children.

R. G. Kesel, University of Illinois, before the Society of Cosmetic Chemists, New York, Dec. 8, 1949.

## PUMPS

### . . . *Viscous Materials*

W. E. Worcester

The rotary pump has taken its place handling viscous materials.

Now we not only pump tar, heavy fuel and lubricating oils, glucose and molasses at temperatures that were believed impossible forty years ago, but also asphalt, wood rosin, cellulose acetate, plastics, loaded coating asphalt, commercial white lead and many other products that were not pumped at all then.

For many years the friction power required within the pump because of the rotation of the parts in viscous, sticky liquids was just a guess. This problem has had considerable research. Now for a pump with known surface areas, clearances and operating speed, the horsepower required for a liquid of known viscosity is obtainable. From such data, the additional power for increased viscosity may be computed. With all types, the power increases rapidly with the increase in the rotating speed, and for at least two types, the power required varies with the square root of the absolute viscosity.

It develops that frequently it is worth while to use a large pump operating at low speed rather than a small unit at high speed. Some of the

**BASS ACKWARDS?**

**"Under the constant yammering of the politicians, too many people have come to believe that industry is a drag on society and government is the only real champion of progress."**

**J. M. Lovejoy, *President Seaboard Oil Co. of Delaware***

additional cost of the pump is saved in the cost of the prime mover, and the savings in operating cost and longer service without repairs provide additional economies.

Power savings alone are not the sole reason for the use of such speed modifications. We all know that the pump cannot crawl down the pipe to get the liquid. All the pump can do is to produce a partial pressure in the suction pipe. No more liquid will reach the pump than the differential pressure will force through the pipe. Since we must use some of this to overcome friction, some more to elevate the liquid if the source of supply is below the pump, too frequently we have little left to force the liquid through the pump inlet to the rotors and fill them in the time they are exposed to the suction port. As we increase the size of the suction ports and slow the pump down, we, at the same time, insure the rotors will fill and improve the pump performance.

In keeping with the accumulation of valuable engineering data, there has been a corresponding improvement in the mechanical features and construction of rotary pumps.

The application of the knowledge we now have on friction losses, pump speeds, and pumps make it worthwhile to restudy many existing installations. Frequently, larger suction lines, relocation of pumps, and perhaps the use of variable speed driving units will obviate unnecessary heating of storage tanks, reduce the size of boilers and heat exchangers, cut fuel and power bills, and so greatly improve performance that replacement of present facilities will prove economical.

Today you can pump almost any material if it will squeeze to a film under pressure. Most pump troubles do not exist. They are, instead, difficulties encountered before the liquid reaches the pump, and the application of information now available regarding pipe friction losses, effect of gases, inlet losses, and velocities of moving parts will produce much more satisfactory and economical installations.

William E. Worcester, Kinney Manufacturing Co., before First Pan American Engineering Congress, Rio De Janeiro, July 15-24, 1949. —*End*


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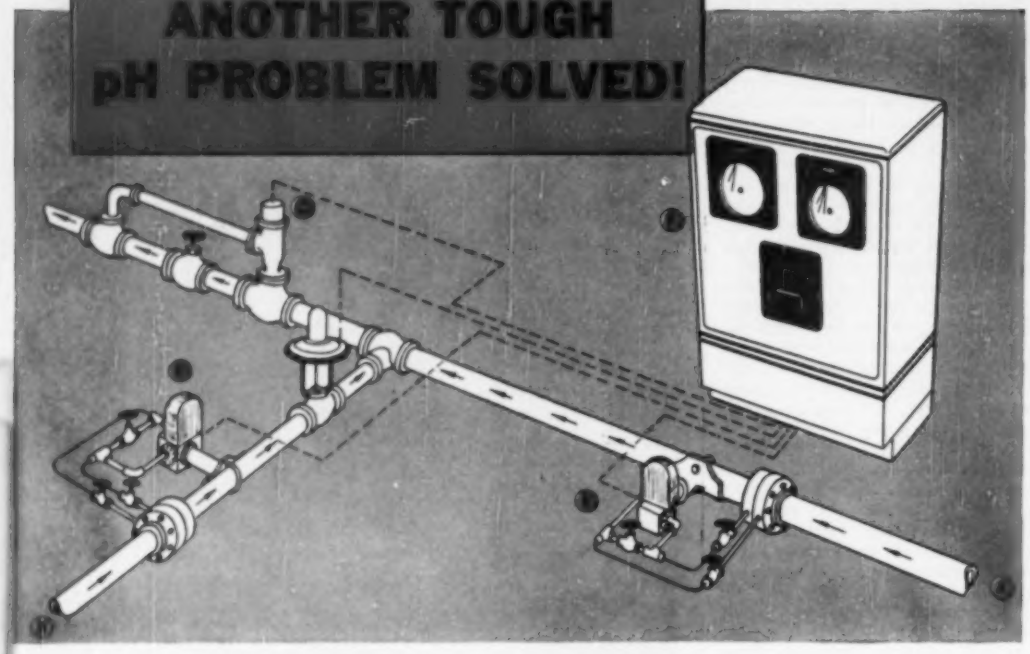
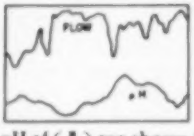
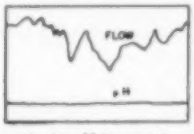
# ANOTHER TOUGH pH PROBLEM SOLVED!



## . . . by FOXBORO Coordinated Control




**THE PROBLEM:** To control the pH of fluid (A), a corrosive material varying both in volume and concentration. Flow and unadjusted pH of (A) are shown in curves (left). Since there is no capacity in the system, the high rate of change of flow makes simple pH control inadequate. Adjusting chemical (B) is in a head tank and has constant concentration.




**THE SOLUTION:** Flow ratio control is employed to maintain the flow of (B) in precise relation to the varying flow of (A). The ratio itself is continuously adjusted by a pH controller. Flow measurements are transmitted to the ratio controller by stainless steel differential pressure cells (D) and (E), while pH is measured at a point (C) where the reaction is complete.

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COORDINATED CONTROL

**BOOKSHELF**

(Continued from p. 99)

by a quantum mechanical approach to a philosophical world picture could not fail to impress everybody.

Few minds have had as much of an impact on our present day thinking—quite aside from philosophy—than Einstein and Planck. The general public has perhaps heard more about Einstein's relativity theory than about the quantum theory of Planck, yet the two great edifices of thought are irrevocably interwoven and it is quite fitting that we have now available not only Planck's life story as told by himself, but also a number of essays which appeared in 1947 and 1948. These papers deal with phantom problems in science, with the meaning and limits of exact science, with the concept of causality in physics, and with religion and natural science. There is also an introduction, namely the memorial address delivered by Max von Laue at Planck's bier.

It does behoove a scientist to sit down sometimes and take stock of how his discipline fits into the frame of a general philosophy. There is perhaps no better way to accomplish such a goal than to study Planck's thoughts as expressed in his autobiography and essays. This will be a fascinating experience for most; and by no means dull! Here is an amusing observation (p. 33) which indicates Planck's subtle sense of humor: "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it."

Planck was a deeply religious man and his trust and humility become apparent when he says (p. 119) "And he whom good fortune has permitted to cooperate in the erection of the edifice of exact science, will find his satisfaction and inner happiness, with our great poet Goethe, in the knowledge that he has explored the explorable and quietly venerates the inexplorable."

It would indeed be gratifying if the reviewer could stop here and say unequivocally how much he enjoyed rereading Planck's essays and how he hopes that his fellow scientists will turn to this little volume for moments of introspection and study. However, there are some reservations which are not directed at the physicist and philosopher Planck but at his translator. As a whole, Mr. Gaynor has done a commendable job, but that is not enough. It is as if someone sets out to make a color photograph of a great painting, but the reproduction is found wanting for lack of photographic skill. A number of passages are harsh and clumsy. Furthermore, the translator apparently has but a smattering acquaintance with physics or mathematics. Hence he translates "Grösse" as magnitude where he should use quantity. When the author makes reference to the atomic pile in the state of Washington (Hanford) and wonders about the fact that the temperature of the Victoria River is raised, he is not to be blamed for an error in geographical terminology. But the translator could well have substituted the word Columbia River since he is a resident of this country. And so it goes on—even to the point (and here the publisher's proof reader is at fault) of several typographical errors.

To sum it up: All these minor points can do no harm to Planck's stature, but they are highly irritating. Hence this reviewer must temper his otherwise enthusiastic recommendation with a few reservations.

RECENT BOOKS RECEIVED

*Electron Microscopy.* By R. W. G. Wyckoff. Interscience. $5.

*Electronics in Engineering.* By W. R. Hill. McGraw-Hill. $3.50.

*Elements of Thermodynamics and Heat Transfer.* By E. F. Obert. McGraw-Hill. $4.50.

*Engineers' Dictionary, Spanish-English and English-Spanish.* By L. A. Robb. Wiley. $12.50.

*The Essential Oils, Vol. III.* By E. Guenther. Van Nostrand. $10.

*Experimental Physical Chemistry.* 4th ed. By F. Daniels, J. H. Mathews, and J. W. Williams. McGraw-Hill. $4.50.

*Introduction to Chemical Engineering Thermodynamics.* By J. M. Smith. McGraw-Hill. $4.

*A Measure for Greatness.* By D. O. Woodbury. McGraw-Hill. $4.

*Numerical Analysis of Heat Flow.* By G. M. Dusinberre. McGraw-Hill. $4.50.

*Physical Methods of Organic Chemistry, Part II.* By A. Weissberger. Interscience. $12.50.

*Principles of Electroplating and Electroforming. 3rd ed.* By W. Blum and G. B. Hogaboom. McGraw-Hill. $6.

*Principles of a New Energy Mechanics.* By J. Mandelker. Philosophical Library. $3.75.

*Pump Questions and Answers.* By R. Carter, I. J. Karassik, and E. F. Wright. McGraw-Hill. $5.

*Refractories.* 3rd ed. By F. H. Norton. McGraw-Hill. $8.50.

*Scientific and Technical Abbreviations, Signs and Symbols.* 2nd ed. By O. T. Zimmerman and I. Lavine. Industrial Research Service. $8.

*Soils: Their Physics and Chemistry.* By A. N. Puri. Reinhold. $7.

*Strength of Plastics and Glass.* By R. N. Haward. Interscience. $5.50.

*The Transuranium Elements, Parts I and II.* By G. T. Seaborg, J. J. Katz, and W. M. Manning. McGraw-Hill. $15.

**Cane and Beet**

SUGAR: ITS PRODUCTION, TECHNOLOGY AND USES. By Andrew Van Hook. Ronald Press Co., New York. 155 pages. $3.

Reviewed by Gustave T. Reich

This small book is intended "for everyone interested in sugar and the sugar industry." It opens with the chemistry of sugar and contains brief descriptions of the terms commonly used in the sugar industry. Two succeeding chapters describe the manufacture of cane and beet sugar; also the use of ion-exchange resins.

Chapter 4 deals with the commercial trade aspects and production of sugar in the foremost sugar producing countries. Byproducts, such as the utilization of cane bagasse, beet pulp, molasses and chemicals from sugar are covered in a separate chapter. The last 25 pages give the history of this industry.

The book is written in a clear, concise form, containing 24 illustrations and 14 tables, and the author achieved his aim.

**48 '48 Papers**

PROCEEDINGS OF THE INTERNATIONAL CONGRESS ON RHEOLOGY, Holland, 1948. Interscience Publishers, Inc., New York. 641 pages. $11.

*Reviewed by George E. Alves*

The International Congress on Rheology was held in Holland, September 1948. The 48 papers, discussions, and the report on rheological nomenclature are in the proceedings. All of the material is in English, except six papers which are in French.

A general survey of rheology in industry is presented in one paper; however, individual papers are given on the rheology of many specific substances ranging from printing inks to building materials.

Individual experimental methods and general rules for applying the methods to obtain fundamental rheological properties of materials are discussed. The viscometry of settling suspensions with a Stormer viscometer is very well treated. It was noted that the work performed by the stirrer to maintain the particles in suspension was a large fraction of the total work.

Theoretical aspects of rheology are treated in several papers. Observations of certain elastic liquids studied in a rotational viscometer are described in a very interesting paper and a short paper considers the spinning properties of certain fluids.

(Continued)

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The limits of viscous flow of non-Newtonian solutions are treated in several papers. Transition between viscous and turbulent flows occurred at a critical Reynolds number, based on the limiting viscosity, of approximately 2,000. The critical Reynolds number appears to be a function of the rate of shear and the size and shape of the molecules. A wall effect for the flow of some non-Newtonian solutions were observed and is discussed in detail.

Various problems and systems of nomenclature are reviewed. The report on the principles of rheological nomenclature offers recommendations for a system of nomenclature. More accurately descriptive terms are proposed in place of the terms presently used in the literature.

These proceedings are a definite contribution to the literature on rheology and are well recommended to chemical engineers and others engaged in research in such fields involving fluid flow and agitation.

**Bilingual**

SURFACE CHEMISTRY. Edited by The Faraday Society. Interscience Publishers, Inc., New York. 334 pages. $6.

*Reviewed by Irving Reich*

The broadening field of surface chemistry is becoming more important every year. The average chemist or chemical engineer, regardless of what he may specialize in, finds it increasingly necessary to have some basic understanding of adsorption, emulsification, wetting, etc. One need only mention synthetic detergents, emulsion polymerization, chromatographic analysis, or lubrication theory, to realize how fundamental surface chemistry is to the comprehension of many important new fields.

The present book is not at all a basic text, as its title might seem to imply. It is rather a collection of research papers presented in October 1947 at a joint meeting of the Société de Chimie Physique and the Faraday Society, in honor of an eminent investigator in this field of chemistry, Professor Henri Devaux. The title chosen is unfortunate, as it suggests that the book is in the category of the classic general tests of Rideal and Adam, and the more recent books of Bikerman and Schwartz and Perry. Of the 42 papers, 21 are in French and 21 are in English. Each paper is also summarized in the other language.

This collection will not be of great interest to the average chemist or engineer. It will be primarily of value to one who is quite familiar with surface chemistry and who wishes to keep up to date on concepts and experimental technics in this field. In that respect it would perhaps be the equivalent of a volume of *Journal of Colloid Science*.

Following the presidential address, which is a short paper by Professor Devaux on the hygroscopicity of monolayers, there is a group of theoretical papers. These include two especially interesting ones by D. J. Crisp on a two dimensional phase rule, covering the application of the Gibbs phase rule to surface or interfacial films.

The next section, comprising nearly half the book, is a group of papers under the designation "Physical Chemistry." The first of these is by A. F. H. Ward on the kinetics of adsorption at liquid-liquid interfaces. Another paper by R. C. Palmer deals with the adsorption of ionized solutes. The basic theory covered should be particularly valuable in treating the effects of salt "builders" on ionic surface-active agents. A paper by K. G. A. Pankhurst discusses complexes formed between gelatine, and sodium lauryl sulphate. Interestingly, these complexes can be oil soluble at certain protein-detergent ratios, presumably due to oriented adsorption of lauryl sulphate with hydrocarbon chains directed outward.

A paper of particular practical interest is that by Lachampt, Aviak and Rossignol on emulsion saponification. This includes a study of the effects of temperature on the reaction, and of the kinetics of the reaction at the oil-water interface. Most of the other papers in the "Physical Chemistry" section describe instrumental methods for the study of surface films or present new data relating to such films.

The next section, entitled "Films on Solid Surfaces," consists of four papers which would be of special interest to lubrication research chemists. This applies particularly to a paper by Tabor and Tingle on the mechanism of lubrication by fatty acids.

The last section is entitled "Biophysical Chemistry." In this group broadest interest will undoubtedly be attached to a set of four papers by A. E. Alexander and collaborators, appearing under the heading "Collodial Electolytes, their Biological Activity and Influence upon other Bioligically Active Compounds, with Particular Reference to Soaps and Soap/Phenol Mixtures." This includes some enlightening discussion of the properties of typical anionic and cationic agents in biological systems.

In summary, this book brings together a group of research and discussion papers on various aspects of surface chemistry. It is not a fundamental text or reference work. Because of the

bilingual feature, the number of pages of text is effectively only about two-thirds of the listed 334. It will be desired by those who work extensively in the field of surface chemistry, but probably not by many others.

**Mfrs. Pub.**

KAOLIN CLAYS AND THEIR INDUSTRIAL USES. J. M. Huber Corp., New York. 141 pages.

Opening with a review of the technology of producing, refining and testing kaolin clays, this book goes on to treat in some detail its principal uses in industry.

Greatest emphasis is placed on kaolin clays in the paper industry, with six chapters devoted to the subject. Characteristics (such as abrasiveness, Brightness, dispersibility and particle size) and tests for their determination are discussed. There are chapters on filler grade clays, coating grade clays, the clay content of paper and clays in wallpaper.

Uses of clay in rubber, adhesives, insecticides and ceramics are each treated in separate sections. All material is amply illustrated by charts, tables and photographs.—*FA*

**Laboratory**

PRINCIPLES AND PRACTICE IN ORGANIC CHEMISTRY. By Howard J. Lucas and David Pressman. John Wiley & Sons, Inc., New York. 557 pages. $6.

*Reviewed by David Curtin.*

This book is more than a laboratory text for a course in elementary organic chemistry. Perhaps the most unusual feature is an introductory chapter on chemical reactivity which includes discussions of reaction rate, equilibrium, heat of reaction, bond and resonance energy and free energy. The thermochemical concepts presented here are used throughout the text.

There is an excellent series of chapters on techniques such as melting point determination, crystallization, and distillation.

The main body of the book is devoted to the consideration of synthetic methods as applied to the more common classes of organic compounds. Generally, laboratory directions for several alternative synthesis are described and experiments on the properties of each functional group are included. The synthetic part of the book contains more than enough material for a one year course. In addition to the sections discussed above there are chapters on the solubilities of organic compounds, chromatography and qualitative organic analysis.

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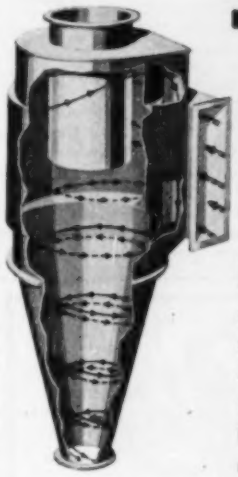

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The book seems to have been carefully prepared and, in view of its broad scope, should be most valuable for students who are planning to specialize in chemistry. The chief disadvantage to its use in an introductory course is its price which is considerably higher than that of the average laboratory text in this field.

**Hazards**

INDUSTRIAL HYGIENE AND TOXICOLOGY. Vol. II. Edited by Frank A. Patty. Interscience Publishers, Inc., New York. 603 pages. $15.

*Reviewed by Morris B. Jacobs*

This book is designed to present the topic of industrial hygiene and toxicology in sufficient detail to be useful to all persons interested in safeguarding the health and welfare of working people by controlling their working environment. Seven chapters are devoted to inorganic industrial hazards, an entire chapter being given to lead, and 12 chapters, divided into the usual functional organic groups, are devoted to organic industrial solvents and poisons.

In general each element, compound, group of compounds or atmospheric contaminant is discussed from the points of view of uses and industrial exposures; physical and chemical properties, often giving constants not commonly found in the literature; physiological response; excretion and absorption; maximum permissible limits and odor and warning properties; and flammability. Almost no analytical methods are detailed but there are many references and a very useful bit of information detailed for many compounds is the relationship of 1 mg. per l. of the compound converted to parts of the compound per million parts of air and mg. per cu. m. at 25 deg. C. and 760 mm.

In the last chapter of 65 pages the recognition and control of potential industrial exposures is considered. Some 70 industrial processes are covered with particular stress on battery manufacture, foundry operations, and metal cleaning processes.

There are over 1,500 references of which 126 are devoted to the halogen compounds, 423 to metals other than lead, 247 to alcohols, and 214 to phenols and phenolic compounds.

It is to be hoped that in the next reprint or edition, the impression that carbon dioxide is a simple asphyxiant will be eliminated. Carbon dioxide is a gas that is toxic to human beings when its concentration is high for it paralyzes the respiratory center.

Proof has been carefully read. The book is well printed on a page size somewhat larger than usual 6¼ by 9¼ in. The chemical engineer and chemist will find this book of value for work in the fields of industrial hygiene and toxicology.

**Ten Reactions**

ORGANIC REACTIONS. Vol. V. Edited by Roger Adams. John Wiley & Sons, New York. 446 pages. $6.

*Reviewed by Ernest I. Becker*

This fifth volume is another valuable addition to the growing series, "Organic Reactions," edited by Roger Adams. The comments made by reviewers of the earlier volumes need hardly be repeated here. It goes without saying that the articles in this volume are also timely and authoritative surveys of certain organic reactions. As in previous volumes, the discussion in each chapter concerns a number of aspects of some one organic reaction—the nature of the reaction, its mechanism, its scope and limitations, and tables of compounds, including products and yields, which have been subjected to the reaction. Although each chapter is probably not all-inclusive for the reaction in question, very valuable, extensive, and critical bibliographies are provided. Of


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no less importance are the astute discussions which often point out directions in which future research should prove very fruitful. Chapter 1 is noteworthy in that methods of analysis for acetylenic hydrocarbons as well as their synthesis are given.

Volume V contains ten chapters entitled, respectively, "The Synthesis of Acetylenes," "Cyanoethylation," "The Diels-Alder Reaction: Quinones and Other Cyclenones," "Preparation of Aromatic Fluorine Compounds from Diazonium Fluoborates: The Schiemann Reaction," "The Friedel and Crafts Reaction with Aliphatic Dibasic Acid Anhydrides," "The Gattermann —Koch Reaction," "The Leuckhart Reaction," "Selenium Dioxide Oxidation," "The Hoesch Synthesis," and "The Darzens Glycidic Ester Condensation."

This volume should find itself on the shelves of the library of every chemist from the executive to the laboratory worker.

**Aluminum—Magnesium**

TECHNOLOGY OF LIGHT METALS. A. von Zeerleder. Elsevier Publishing Co., New York. 366 pages. $6.

The present century has seen light metals introduced into the workshop. Their applications are extending all the time to new industrial fields. Facts that must be known in order to work aluminum and magnesium alloys have been collected in this manual. Designers, engineers and practitioners will find the how-to information here with emphasis on recent developments. Theory has been included only when necessary for comprehension of correct fabricating practice.

A. J. Field has translated the book from the German.—*FA*

**Trihydric**

GLYCERINE AND SOME GLYCERINE DERIVATIVES. Beilstein's Handbook of Organic Chemistry. Glycerine Research Committee of the Association of American Soap and Glycerine Producers, Inc., New York. 210 pages. $2.50.

*Reviewed by Donald F. Othmer*

Here, in 210 pages including a rather complete index, is the literature from 1910 through 1929 on glycerine and those glycerine derivatives which may be formed by a single chemical step. The material from Beilstein's fourth edition and the first two supplements has been translated by a staff of several translators and edited by a staff of some five editors, to make it more available to those interested in this country in the use of glycerine

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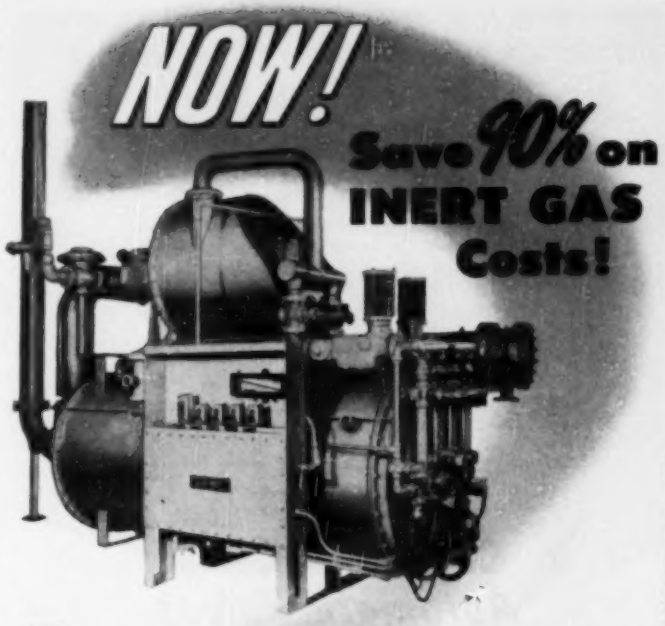


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The translation has been prepared with the permisison of the Attorney General in the public interest under license from the Alien Property Custodian. It represents a further and most helpful means of making available much of the chemistry on a most important material in the chemical industry.

**Done and Terminated**

SPECTROSCOPIC PROPERTIES OF URANIUM COMPOUNDS. By G. H. Dieke and A. B. F. Duncan. McGraw-Hill Book Co., New York. 290 pages. $2.75.

*Reviewed by Edwin K. Jaycox*

This volume is one in the National Nuclear Energy Series of publications and has been prepared as a record of work done under the Manhattan Project and the Atomic Energy Commission. Drs. Dieke and Duncan have undertaken to correlate all the data concerned with the spectroscopic properties of uranium and its compounds that have been obtained by many investigators engaged in this field.

The book represents the most comprehensive study yet made of the spectroscopic properties of uranium and its compounds. This study covers the many aspects of the experimental techniques involved, the features of fluoresence and adsorption spectra, the crystal structure, the growing of crystals and the synthesis of various uranyl compounds. Because of its wide coverage the work is incomplete in many areas. This is understandable since it is a report of work done and terminated, at least in many phases, at the close of the war because of the scattering and unavailability of much of the personel. However the work that was accomplished and reported upon in this treatise is of immense value and has laid the foundation for nuclear physicists to carry on and delve deeper into those secrets of nature concerning uranium and its compounds. It has contributed knowledge of enormous value to aid in the understanding of the structure of matter, particularly that of the solid state.

The text occupies about two-thirds of the volume and is written in a concise, factual and almost outline form, with headings and numbered paragraphs. This makes for easy reading and later reference, although throughout the book the reader feels that in many spots more could have been said. However, since Dicke and Duncan have presented the data of many collaborators, they perforce have had to adopt the role of editors rather than authors. They have therefore presented only the experimental findings in many instances without elaborate discussion, leaving the reader to make the best use he can of the data. Throughout the book references are made to an extensive bibliography.

The appendix contains wavelength measurements of the fluorescence and absorption spectra of various uranyl compounds and all the known data concerning these compounds. The appendix alone is of great value to the nuclear physicist or spectroscopist who wishes to delve deeper into the structure of matter.

**Banana Research**

BANANAS. By Harry W. Von Loesecke. Interscience Publishers, New York. 188 pages. $4.50.

Chemical composition and biochemical behavior of bananas and their products are the chief concern of this volume. It outlines fundamental research done on structure and development, commercial storage and ripening methods, chemical changes during ripening, transportation, nutritive value, diseases and insect pests, banana products.

"Bananas" is the first of a series of monographs to be entitled "Economic Crops." The purpose of the series is to sort out the wealth of analytical data on the chemical constituents of plant tissues.—*FA*

**Gap Bridger**

DIE THERMODYNAMIK DES WARME —UND STOFFAUSTAUSCHES IN DER VERFAHRENSTECHNIK. (Thermodynamics of heat and material interchange in process engineering.) By Warner Matz. Dietrich Steinkopff, Frankfurt am Main, Germany. 355 pages. DM 26. (Cloth Bound, DM 28.)

*Reviewed by Max F. Wulfinghoff*

This is a somewhat advanced engineering text offered at the suggestion of practicing chemical engineers in an attempt to bridge the gap which exists between rigorously mathematical treatises on the one hand, and customary process equipment books on

(*Continued*)

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the other. Dr. Matz wrote it between 1941 and 1944, and the coverage of work done up to that time by European scientists (including the author himself), and up to 1940 by such American authorities as Chilton and Colburn, Gilliland, Lewis and Randall, Murphree, Othmer, Sherwood and others is adequate. The chapters briefly review methods and fundamentals on the state of matter, the first and second law of thermodynamics, laws of similarity, and the mechanics of heat and material transfer. The bulk of the volume (230 pages) is devoted to detailed discussions (with numerical examples) of special cases from the field of heat exchange, evaporation, distillation, adsorption, absorption, and extraction. The application of graphical methods has been stressed wherever possible, and considerable space is given to dimensional analysis. An appendix outlines the use of vector analysis in the treatment of closed cycles.

**Essays**

CONSTRUCTIVE USES OF ATOMIC ENERGY. By S. C. Rothmann. Harper & Brothers, New York. 258 pages. $3.

*Reviewed by Norman R. Beers*

This book consists of 14 independently written esays by experts in various phases of the atomic industry, with a preface, chronological list of highlights significant to atomic energy, glossary, bibliography, and index. It is the editor's stated objective, "to bring into focus our present knowledge about nuclear energy, especially its potentialities for purposes other than war."

All these essays are good. The preface is carefully written and the appendixes and index are useful. Much care has gone in the selection of the material, in its editing, and in its production. Photographs and line drawings are plentiful and excellent. But the book as a whole lacks punch. There is nothing in it to offend nor to compliment the reader who, it appears to this reviewer, is necessarily left with the feeling that something important is left unsaid. Even with the inclusion of excellent and positive statements about the usefulness of nucleonics in ceramics (which is stated to be the oldest industry now serving mankind), workable descriptions of radioactivity in chemical process control, and an illuminating survey of industrial applications—the reviewer finds these and other good things offset by the sparring with health hazards, security, atomic power

possibilities, and the A-bomb always in the wings and ready to come on stage.

These mild criticisms are not directed at the editor of the book so much as at the content of the essays available for editing. It is unfortunately impossible to find a selection of articles, by persons of authority in their fields, which cover the (too) wide scope of the book. Presumably the editor and publisher preferred to retain the authority of the original authorship, impressive as it is, rather than write and publish a book written by one man and from an integrated point of view. This composite technique has been successfully used when the articles contained are scientific or technical in content; the present reviewer finds nothing to recommend it in a book meant to be read by the layman.

### Recent Books & Pamphlets

**Why Industry Moves to Louisiana.** State Board of Commerce and Industry, Baton Rouge, La.

**Atomic Energy Commission Official Records.** Fourth Year, Special Supplement No. 1, published by Columbia University Press, Morningside Heights, New York. 75 pages. 80 cents. "Recommendations of the Atomic Energy Commission for the international control of atomic energy and the prohibition of atomic weapons as approved at the third session of the general assembly." Book contains English and French texts.

**Compressibility Charts and Their Application to Problems Involving Pressure-Volume-Energy Relation for Real Gases.** Research Bulletin P-7437, published by Worthington Pump and Machinery Corp., Harrison, N. J. 25 pages.

**Vitamins, Coenzymes and Nucleotides.** By Alexander R. Todd. Nieuwland Lectures, Vol. III, 1948, published by the University of Notre Dame, Notre Dame, Ind. 53 pages. Report on research on the organic chemistry of the B group of vitamins.

**Standard Methods for Testing Petroleum and Its Products.** Tenth Edition. Published by the Institute of Petroleum, Manson House, 26 Portland Pl., London, W.1, England. 660 pages. 31s.6d. Detailed descriptions of apparatus and procedure of 116 methods for determining physical and chemical properties of crude petroleum and its products.

**English Translations of the Journal of General Chemistry of the USSR.** Published by Consultants Bureau, 153 West 33rd St., New York 1, N. Y. $95, yearly subscription; $12, single issues; $5, single articles. January and February issues are already available.

**Simplification in Industry.** Published by the Anglo-American Council on Productivity, 2 Park Ave., New York, N. Y. 13 pages. 1s. Report on an investigation of the policy of United States producers of deliberate reduction in variety in manufactured products.

**Bibliography on Offshore Petroleum Developments.** By Emory N. Kemler. Publication 1, published by Southwest Research Institute, Division of Oceanography and Meteorology, 312 Oil & Gas Bldg., Houston, Tex. 20 pages. Gratis. Summary of literature available on deep water operations in connection with petroleum production.

**Symposium on Deformation of Metals as Related To Forming and Service.** Special Technical Publication No. 87, published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 117 pages. $2. Five papers deal with re-

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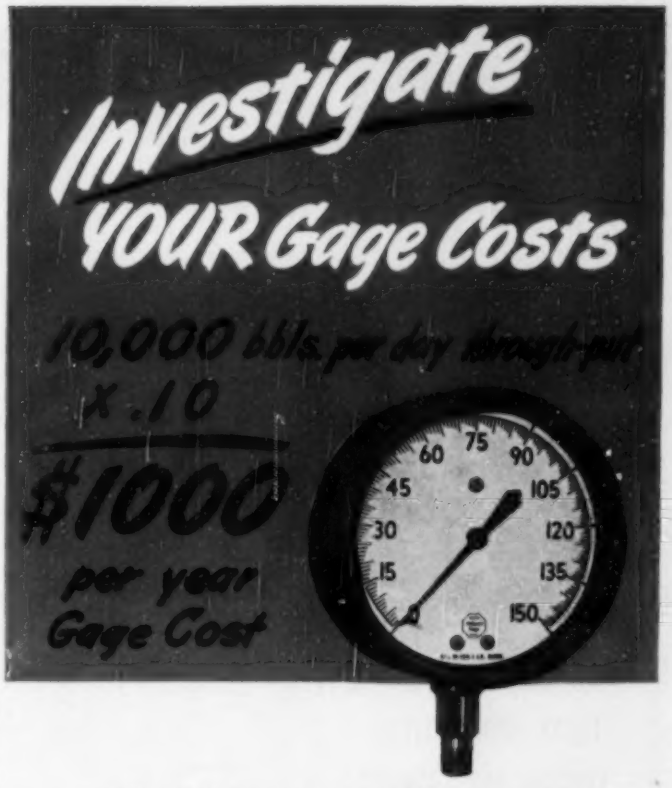


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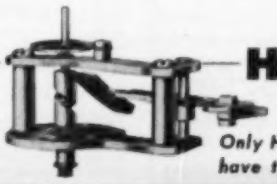

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cent fundamental studies of plastic deformation and flow.

**Production Processes, Their Influence on Design.** By Roger W. Bolz. Vol. I, published by Penton Publishing Co., Penton Bldg., Cleveland 13, Ohio. 568 pages. $16. Each chapter describes a single production process.

**Iodine Abstracts and Reviews.** Vol. No. 2, published by Iodine Educational Bureau, Inc., 120 Broadway, New York 5, N. Y. 30 pages. Iodine and its compounds in chemistry and in the industries.

**Precautionary Fire and Explosion Safeguards in the Use of Chlorine Dioxide for Industrial Bleaching.** Research Report No. 7, published by the National Board of Fire Underwriters, 85 John St., New York. 23 pages. Gratis. Theory of operation, design and construction of equipment, and the safe installation of operation of typical units.

**Metal Cleaning Bibliographical Abstracts.** By Jay C. Harris. Special Technical Publication No. 90, published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 67 pages. $2.75. Over 500 references arranged by year.

**Report of the Fire at the Independence, Kansas Air Base on October 19, 1949 in which 1383 Tons of Fertilizer Grade Ammonium Nitrate Burned.** Published by Spencer Chemical Co., Pittsburgh, Kan. 16 pages. Photographic story of the fire. Includes recommendations for control of ammonium nitrate fires.

**Sugar Derivatives: A Survey of Potential Production Costs.** By Harold E. Bode. Technological Report Series No. 6, Sugar Research Foundation, Inc., 52 Wall St., New York 5, N. Y. In tabulated form, sugar derivatives which are potentially capable of being produced at a material cost of less than one dollar per pound. Includes only sucrose, dextrose, levulose and maltose derivatives listed in Vogel and Georg's Sugar Derivative Tables, published in 1931.

**Meat and Meat Foods.** By Lloyd B. Jensen. Published by Ronald Press Co., 15 East 26th St., New York 10, N. Y. 218 pages. $3.75. Non-technical treatment of processing and preservation from meat plant to consumer.

**Physical and Chemical Examination of Paints, Varnishes, Lacquers and Colors.** Eleventh edition. By Henry A. Gardner and G. G. Sward. Published by Gardner Laboratory, 4723 Elm St., Bethesda, Md. 722 pages. $20.

—*End*

## *GOVERNMENT PUBLICATIONS*

*The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering publications noted in this list give complete title and issuing office. Remittance should be made by postal money order, coupons, or check. Do not send stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, pamphlet is free and should be ordered from bureau responsible for its issue.*

**Radioactive Wastes.** "Handling Radioactive Wastes in the Atomic Energy Program." U. S. Atomic Energy Commission. Price 15 cents. A non-technical report on the safe handling of radioactive wastes in the atomic energy program.

**Surface Coatings.** "Paints, Varnishes, and Related Products." National Bureau of Standards. Simplified Practice Recommendation R144. Price 5 cents. A schedule of specifications for paints, varnishes, and related products (colors and containers) recommended as a useful standard of practice to industry.

**Fats and Oils.** "Fats and Oils. FAO Commodity Series, Bulletin No. 13." Obtain from Columbia University Press, 2960 Broadway, New York 27, N. Y., or Food and Agriculture Organization, 1201 Connecticut Avenue, Northwest, Washington 6, D. C. Price 50 cents.

**Fibers.** "Fibers." FAO Commodity Series, Bulletin No. 14. Obtain from Columbia University Press, 2960 Broadway, New York 27, N. Y., or Food and Agriculture Organization, 1201 Connecticut Avenue, Northwest, Washington 6, D. C. Price 50 cents.

**Plant Costs.** "Bibliography of Investment and Operating Costs for Chemical and Petroleum Plants. By W. I. Barnet. Bureau of Mines, Information Circular 7516. Mimeographed.

**Analysis.** "Laboratories that Make Fire Assays, Analyses, and Tests on Ores, Minerals, Metals, and Other Inorganic Substances." By Bertha R. Klahold. Bureau of Mines, Information Circular 7523. Mimeographed. A directory.

**Sulphur.** "Sulfur In Petroleum. III Selected Physical Properties of Some Sulfur Compounds." By R. V. Helm, et al. Bureau of Mines, Report of Investigations 4566. Mimeographed.

**Coal.** "Coal Carbonization: Effects of Blending Pocahontas No. 3 Coal with 12 High-Volatile A Coals." By D. A. Reynolds. Bureau of Mines, Report of Investigations 4552. Mimeographed.

**Alloys.** "Liquidus Temperatures and Liquid Densities of Zinc-Aluminum Alloys." By I. S. Solet and H. W. St. Clair. Bureau of Mines, Report of Investigations 4553. Mimeographed.

**Synthetic Organics.** "Synthetic Organic Chemicals, United States Production and Sales, 1948." U. S. Tariff Commission, Report No. 164, Second Series. Price 40 cents. The customary comprehensive statistical report of the census conducted annually on these commodities.

**Coal.** "Analyses of Iowa Coals." By Paul Averitt. Bureau of Mines Technical Paper 706. Price 25 cents. A compilation of all published data.

**Iron.** "Iron Blast-Furnace Slag, Production, Processing, Properties, and Uses." By G. W. Josephson et al. Bureau of Mines, Bulletin 479. Price 75 cents. A comprehensive report with bibliography including results of a field study conducted in cooperation with National Slag Association.

**Chemurgy.** "Survey of the Chemical Composition of Cotton Fibers, Cottonseed, Peanuts, and Sweetpotatoes." By J. D. Guthrie, et al. Bureau of Agricultural and Industrial Chemistry, AIC-61 (revised March 1949). Mimeographed. A literature review.

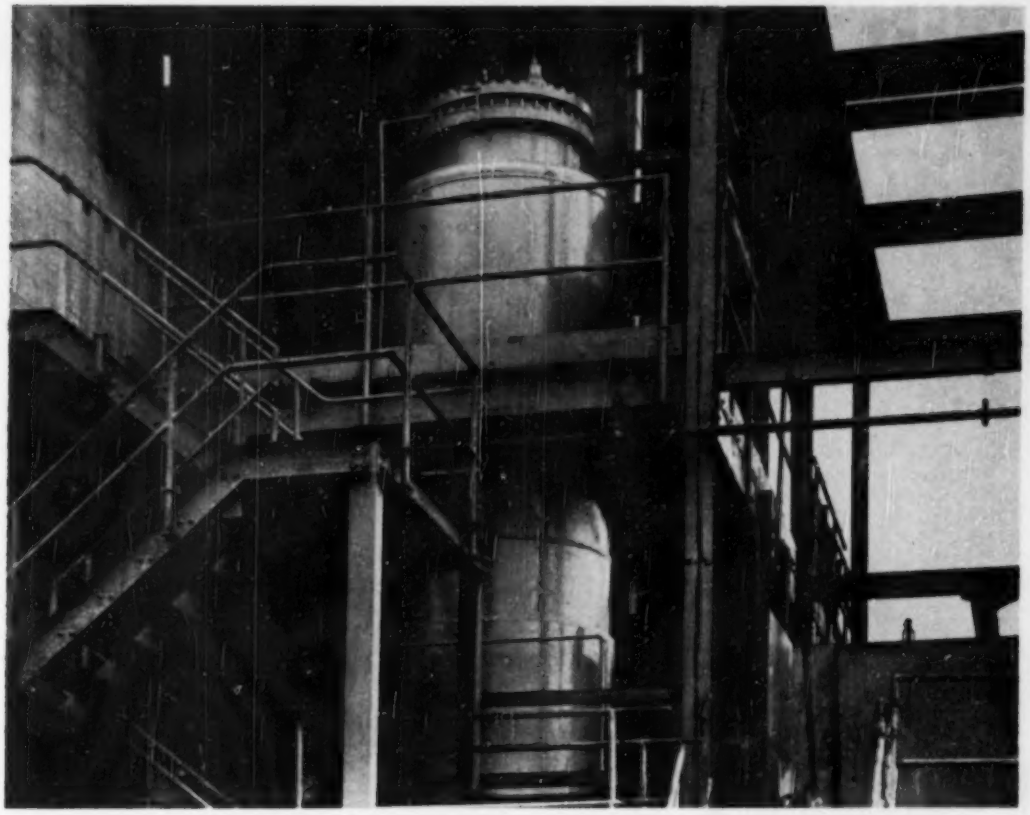
**Vitamin $B_{12}$.** "Fermentation Process for Production of Vitamin $B_{12}$." By J. C. Lewis, et al. Bureau of Agricultural and Industrial Chemistry, AIC-254. Mimeographed.

**Transportation.** "Recent Trends in Truck Weight Limitations." The Marketing and Transportation Situation MTS-78, November 1949. Bureau of Agricultural Economics. Mimeographed. Important for the traffic departments of all types of industry.

**Soybeans.** "Soybeans, Culture and Varieties." By W. J. Morse, et al. U. S. Department of Agriculture, Farmers' Bulletin No. 1520. Price 15 cents. Revised edition summarizing present knowledge.

**Business.** "Statistical Supplement to Survey of Current Business, 1949." U. S. Department of Commerce. Price $1.25. This Supplement tabulates data published during 1948 and preceding years in rather complete detail. In many cases with averages back as far as 1935.

—*End*



# CHEMSTEEL INSTALLATION LASTS 6 TIMES LONGER THAN ANY PREVIOUS CORROSIVES HANDLING EQUIPMENT

This Chemsteel reaction vessel, installed at one of the country's leading chemical plants, handles a corrosive mixture of hydrochloric acid and organic solvents at 350° F. operating temperature and 40 p.s.i. operating pressure (60 p.s.i. design pressure). It has given continuous, trouble-free service for more than a year . . . and still shows no evidence of wear.

Until the vessel was installed, units handling this job had lasted only from 6 to 8 weeks. Thus the Chemsteel installation has already lasted six times as long as any previous equipment . . . and is still going strong!

Such a record is typical of Chemsteel results.

The above installation was handled by using a 5' I.D. x 20' steel shell lined with a special triple-layer impervious membrane and dual construction "Duro" acid-proof brick. Graphite sleeves were used in nozzle liners and Karbate slotted couplers with steel back-up rings were provided on the flanges.

You, too, can profit by Chemsteel specialized construction services. Backed by wide and varied experience serving major steel, chemical, textile and food plants, Chemsteel will design, select and obtain materials, and erect new corrosion-proof construction . . . handle maintenance work . . . or work cooperatively with your engineering firm or contractor in any one of these functions.

***For complete details write for Bulletin A4.***

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**5428 Walnut St., Pittsburgh 32, Pa. Telephone MUseum 1-7500**

# THERE'S A MONARCH NOZZLE FOR EVERY SPRAY JOB

Remember—if the liquid can be sprayed with direct pressure Monarch can furnish the Nozzles.

Fig. 780

In many industries Monarch Spray Nozzles are used for . . . .

*ACID CHAMBERS*
*AIR WASHING*
*CHEMICAL PROCESSING*
*COOLING PONDS*
*DESUPERHEATING*
*GAS SCRUBBING*
*HUMIDIFYING*
*OIL BURNERS*
*SPRAY DRYING*

*Catalogs 6 A and 6 C Sent on Request*

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## *MANUFACTURERS' LATEST PUBLICATIONS*

*Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterheads.*

**Hydrogen Chloride Gas.** National Carbon Co., 30 East 42nd St., New York 17, N. Y. —6-page Catalog Section M-9002 describes and illustrates equipment for production of hydrogen chloride gas by burning hydrogen and chlorine. Describes graphite combustion chamber and impervious graphite burner nozzle, outlines operation of complete system.

**Caustic Soda.** Allied Chemical & Dye Corp., Solvay Sales Division, 40 Rector St., New York 6, N. Y.—Wall chart lists precautions for handling caustic soda.

**Materials Handling.** Lyon-Raymond Corp., Greene, N. Y.—16-page booklet discusses how proper positioning of materials may save unnecessary handling during production operations.

**Resins.** Alkydol Laboratories, Inc., 2242 South Fiftieth Ave., Cicero 50, Ill.—36-page Catalog 772 covers properties and applications of ester gums, modified phenolic resins and maleic resins.

**Heaters.** Prat-Daniel Corp., Thermobloc Division, East Port Chester, Conn.—Data file 901 provides tables for computing heat loss and requirements. Catalogs self-contained direct-fired industrial heating units.

**Air Valves.** Beckett-Harcum Co., 1140 Wayne Rd., Wilmington, Ohio.—6-page Bulletin 10 contains data on operation and construction of valve for control of air cylinder action. Each model is sketched.

**Surface Coatings.** American Cyanamid Co., Coating Resins Dept., 30 Rockefeller Plaza, New York 20, N. Y.—Booklet tabulates the physical and chemical properties of coating resins for use in surface coatings and printing inks.

**Kettles.** Groen Mfg. Co., 4539 West Armitage Ave., Chicago 39, Ill.—Two 4-page leaflets illustrate a line of stainless steel industrial kettles. Bulletin IN-1 covers deep-type and jacketed tilting kettles and horizontal and vertical tanks. Bulletin VP-1 covers vacuum and coating pans (revolving).

**Pumps.** De Laval Steam Turbine Co., Trenton 2, N. J.—4-page Catalog LG contains cutaway drawings of six types of rotary pumps with a brief description of each. The line is well suited to oil burner, pressure lubrication and hydraulic pressure services.

**Conveyors.** Jeffrey Mfg. Co., Columbus 16, Ohio.—4-page Bulletin 826 illustrates and lists the features of a mechanical vibrating conveyor.

**Filters.** Filtration Engineers, Inc., 155 Oraton St., Newark 4, N. J.—24-page Bulletin 103 outlines principles of continuous rotary vacuum filtration. Large cutaway view shows how rotary vacuum filter operates.

**Heaters.** Kold-Hold Mfg. Co., Lansing 4, Mich.—6-page folder gives data on this company's Platecoil method of heat exchange.

**Centrifugal Filters.** Bird Machine Co., South Walpole, Mass.—4-page folders shows typical installations of continuous centrifugal filters.

**Chemicals.** Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio.—16-page booklet for the general public on eight major groups of chemicals including soda ash, caustic soda, chlorine and calcium. Tells how they aid in production of common necessary items.

**Pumps.** Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago.—5 booklets contain operating data, construction details and cutaway drawings of various types of pumps. Bulletin 5520A, 8 pages, and Bulletin 5520P-3, 6 pages, cover centrifugal pumps. Bulletin 5810-9, 20 pages, covers single stage, split case centrifugal pumps. Bulletin 5416-7, 16 pages, covers sewage and trash pumps; Bulletin 5469-2, 8 pages, covers paper stock pumps.

**Water Treatment.** Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y.—8-page leaflet outlines principles of deaeration, describes design, operation and applications of vertical and horizontal heaters.

**Blowers.** Buffalo Forge Co., Buffalo 5, N. Y.—8-page Bulletin 3614-D contains charts of capacities and static pressures of a line of blowers.

**Cement.** Eagle-Picher Sales Co., Industrial Insulation Division, American Bldg., Cincinnati 1, Ohio.—8-page leaflet provides photographs and specific data on installation, applications and properties of fireproofing cement.

**Refractories.** Norton Co., Worcester 6, Mass.—4-page leaflet describes pure oxide refractories and their uses.

**Resins.** Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.—two data sheets, each covering properties of a protective coating resin; 10-page booklet is on Durez 220 resin; 10-page booklet is on Durez 220-V. A properties chart for all of this company's protective coating resins is available in a 20 x 21-in. size and a 8½ x 11-in. size.

**Pumps.** Duriron Co., Dayton 1, Ohio.—12-page Bulletin 812A contains instructions on the installation and operation of centrifugal pumps in corrosive service.

**Valves.** Edward Valves, Inc., East Chicago, Ind.—4-page Bulletin 491 contains dimensions, weights, prices and operating data on drop forged steel valves for meter, gage, instrument and other small lines.

**Centrifugals.** Baker Perkins Inc., Chemical Machinery Division, Saginaw, Mich.—12-page booklet illustrates and describes a line of centrifugals made by this company.

**Turntables.** Hardinge Co., 240 Arch St., York, Pa.—4-page Bulletin 48 contains photographs and standard sizes and weights of a line of pressed steel turntables.

**Flooring.** Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio.—36-page booklet discusses features of this company's ironclad concrete floor. Gives information on the product and method used in production of these floors.

**Injection Molding.** Tennessee Eastman Corp., Kingsport, Tenn.—55-page booklet on procedure for injection molding of this company's cellulose acetate and cellulose acetate butyrate thermoplastics.

**Driers.** Witco Chemical Co., 295 Madison Ave., New York, N. Y.—Bulletin gives paint chemists general rules for determining the proper drier for the newer raw materials, with suggestions for handling and testing drier formulations.

**Conveyors.** Fuller Co., Catasauqua, Pa.—24-page Bulletin FK-25 illustrates and describes unloading and conveying of dry pulverized materials. Equipment is sketched and typical installations shown.

**Packaging.** Bemis Bro. Bag Co., 408 Pine St., St. Louis, Mo.—16-page pocket-sized booklet describes briefly the general types of products and services offered by this company.

**Blowers.** Roots-Connersville Blower Corp., 900 West Mount St., Connersville, Ind.—24-page Bulletin 120-B-14 discusses design and construction features of centrif-

(Continued)

If your processing includes purification, isolation or upgrading of organic materials, selective separation with Davison Silica Gel may help you produce a better product at a lower cost.

Research and pilot plant work by some of the nation's largest chemical concerns indicate that, in many cases, selective separation is a cheaper and more thorough process than either distillation or crystallization.

Since Davison Silica Gel is completely stable and is available in various types, it can be supplied in grades which will cause no chemical changes during selective adsorption. Laboratory control of our gel production permits us to produce it with the pore size, internal surface area, density and particle size that will give maximum efficiency in your particular separation process.

*Write for data sheets, samples and technical information . . . or ask to have a Davison field representative call.*

**typical separations:**

Acetylene from Oxygen
Aromatics from Paraffins
Sulfur Compounds from Hydrocarbons
Polar Compounds from Non-Polar Compounds
Moisture from Organic Liquids and Gases

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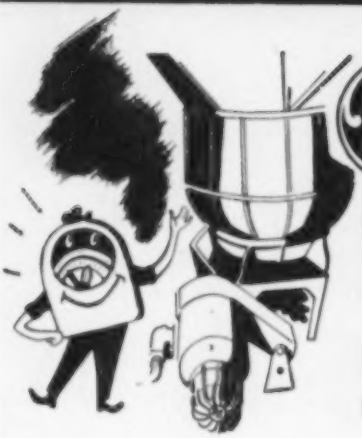
PRODUCERS of SILICA GEL, CATALYSTS, SILICOFLUORIDES, CASTING COMPOUNDS, ALUM, INORGANIC ACIDS, FERTILIZER MATERIALS.

*Leave process timing to the worker who does it best !!*



type TSA-10

# TIME SWITCH

General Electric's TSA-10 Time Switch is designed to make your time-interval operations as automatic as possible, thereby cutting waste and improving product uniformity. It eliminates the "human error" in process timing—frees your operators for more productive work.

Cut down on "process watching" in your plant with this reliable G-E time switch—it will do the job better at less cost. Your dividends: greater uniformity of product, a bigger profit.

**THE TSA-10 IS IDEAL FOR:**

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| *HEAT TREATING EQUIPMENT* | *MIXING VALVES* |
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| *PLASTIC MOLDS* | *AGITATORS* |
| *PUMPS* | *COOKERS* |

*—and many other applications in your plant*

**CHECK THESE OUTSTANDING FEATURES**

Highest accuracy with Telechron® synchronous motor drive . . . external time-set knob provides easy adjustment . . . Pointer indicates elapsed time . . . quick installation with hinged cover, three knockout terminals . . . silver contacts for long life . . . corrosion resistant, dust proof case design.

*Send for Bulletin GEC-452 which describes this TSA-10 Time Switch in detail. The sooner you act, the sooner your savings begin. Address Section B-603-101, Apparatus Dept., General Electric Company, Schenectady 5, New York.*

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GENERAL ELECTRIC


## MFRS.' PUBS., cont. . .

ugal blowers and exhausters. Contains photographs of typical single and multi-stage units.

**Filteraids.** Great Lakes Carbon Corp., Dicalite Division, 612 South Flower St., Los Angeles, Calif.—14-page Bulletin B-12 tells where and how filter aids are used.

**Valves.** Paul Valve Corp., 682 Third Ave., New York 17, N. Y.—12-page Bulletin 103 gives principle of operation and engineering data for a line of valves. Includes sketches of each model.

**Pumps.** Warren Steam Pump Co., Warren, Mass.—4-page Bulletin 246 describes a two stage volute centrifugal pump available in various sizes. Includes cutaway drawing.

**Copper Equipment.** Vulcan Copper & Supply Co., Cincinnati, Ohio.—8-page illustrates and describes the process equipment and services this company offers.

**Motor Accessories.** General Electric Co., Schenectady 5, N. Y.—24-page Bulletin GEA-5334 summarizes the range of application and performance features of adjustable speed units. Four other booklets are available which describe specific units.

**Electronic Controls.** Photoswitch Inc., Cambridge, Mass.—64-page Bulletin PG 4910 presents 45 case studies to show that electronic controls can cut production costs.

**Pumps.** LaBour Co., Elkhart, Ind.—16-page Bulletin 53 illustrates and describes a vertical, self-priming centrifugal pump. Discusses construction, operation and applications. Contains sketches with parts fully labeled.

**Heaters.** Black, Sivalls & Bryson, Inc., 720 Delaware, Kansas City 6, Mo.—8-page booklet describes a heating unit for smaller industrial requirements. Unit can be used interchangeably as steam boiler or hot water heater.

**Resins.** Libbey-Owens-Ford Glass Co., Plaskon Division, 2112-24 Sylvan Ave., Toledo 6, Ohio.—58-page handbook discusses properties, applications and techniques of molding urea and melamine molding compounds. 48-page expandable booklet discusses techniques, uses, instructions and technical data on resin glues. Also available is a slide-rule-type calculator for glue mixing and cost factors. 4-page leaflet gives properties, molding characteristics and technical data on an alkyd molding compound.

**Pump Accessories.** Byron Jackson Co., Pump Division, Los Angeles 54, Calif.—12-page Bulletin 49-10000 describes three types of mechanical seals for centrifugal pumps.

**Steel.** Allegheny Ludlum Steel Corp., Rm. 2036, Henry W. Oliver Bldg., Pittsburgh 22, Pa.—16-page booklet gives procedures and tabulations for the working of tool and high speed steels.

**Magnetic Equipment.** Dings Magnetic Separator Co., 4740 West Electric Ave., Milwaukee 14, Wis.—8-page Catalog C-5000A describes electric and non-electric magnetic pulleys, non-electric magnetic drums.

**Materials Handling.** Harrington Co., 17th and Callowhill Sts., Philadelphia 30, Pa.—4-page Bulletin P-5 illustrates operation of hand chain hoist.

**Waste Disposal.** American Well Works, Aurora, Ill.—24-page Manual 148 summarizes approach to modern waste treatment methods and equipment.

**Instrument Specialties.** Trinity Equipment Corp., 468 Westfield Ave. East, Roselle Park, N. J.—44-page catalog describes basic types of metal protecting wells for indicating, recording and controlling instruments.

**Carbon Black.** J. M. Huber Corp., 342 Madison Ave., New York 17, N. Y.—4-page leaflet gives properties and uses this company's Aromex black.

**Speed Reducer.** Cleveland Worm & Gear Co., 3249-59 East Eighteth St., Cleveland 4, Ohio.—8-page leaflet illustrates appli-

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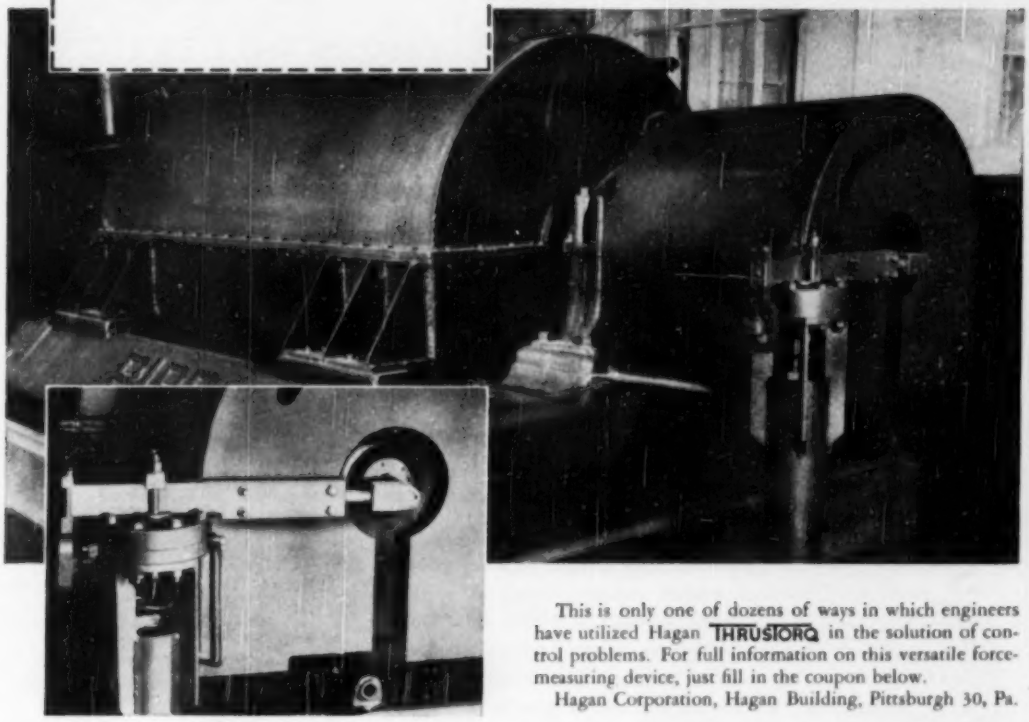
# CONTROL by HAGAN THRUSTORQ



Introduced primarily as a device for measuring thrust and torque, the accurate, sensitive and rugged Hagan THRUSTORQ is finding many applications as the sensitive element in *control* systems, since it produces a linear pneumatic control signal.

One such application—controlling the feed of slurry to a centrifuge—is illustrated here. In this centrifuge operation it is desired to maintain the load on the salt-removal screw conveyor at a constant safe maximum value. This conveyor is driven by a planetary gear.

The Hagan THRUSTORQ continuously measures torque of this planetary gear. The force thus measured is recorded as torque on a pressure-recording instrument, and is also used to control automatically the rate of slurry feed, so as to maintain a pre-determined load on the conveyor.

This is only one of dozens of ways in which engineers have utilized Hagan THRUSTORQ in the solution of control problems. For full information on this versatile force-measuring device, just fill in the coupon below.

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Please send me information on Hagan THRUSTORQ particularly in relation to:

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HAGAN HALL BUDOMIN CALGON

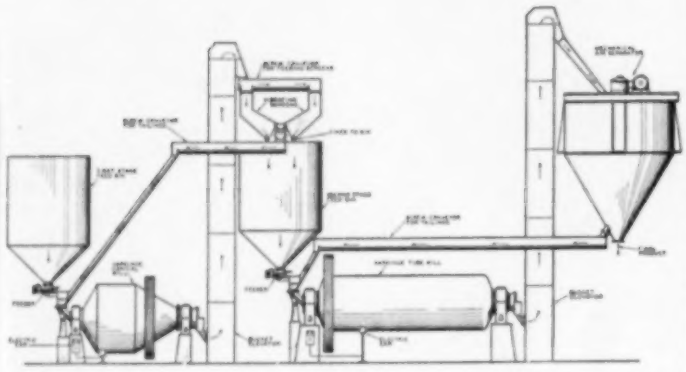
## HAGAN CORPORATION

THRUSTORQ FORCE MEASURING DEVICES
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
BOILER COMBUSTION CONTROL SYSTEMS
METALLURGICAL FURNACE CONTROL SYSTEMS

*"If*

**DRY GRINDING**

*is your problem..."*



SHOWN above is a typical Hardinge solution to a dry grinding problem. Application: cement clinker grinding. The clinker goes through a 10′ x 48″ Hardinge Conical Ball Mill with "Electric Ear". The cone insures rapid discharge of the fines, and produces a 20 mesh product. Oversize from the screen is returned to the mill. In the second stage, the semi-ground cement goes to a Hardinge 8′ x 26′ Ball Tube Mill in closed circuit with an air separator to produce as fine a product as is desired. Output of this combination—125 barrels of cement an hour. Larger Hardinge Mills, capable of producing double this capacity, are available. Write for Bulletin 17-B-11 on the general subject of dry grinding.

**HARDINGE**

COMPANY INCORPORATED

**YORK, PENNSYLVANIA — 240 Arch St. • Main Office and Works**

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MFRS.' PUBS., cont. . .

cations of fan-cooled worm-gear speed reducers.

**Latex.** Monsanto Chemical Co., Plastics Division, Springfield, Mass.—8-page booklet describes physical characteristics of plasticised and unplasticised emulsions of styrene latices.

**Pulverisers.** American Pulveriser Co., 1219 Macklind Ave., St. Louis 10, Mo.—6-page bulletin describes small-scale applications of crushers, grinders and shredders.

**Pumps.** Roots-Connersville Blower Corp., Connersville, Ind.—8-page Bulletin 31-B-17 covers rotary positive gas pumps which may be used as boosters or exhausters.

**Coatings.** Atlas Powder Co., Industrial Finishes Dept., Stamford, Conn.—Folder describes line of primers and primer surfacers.

**Materials Handling.** Hyster Co., 1010 Meyers St., Danville, Ill.—28-page booklet describes attachments, tools and accessories for lift trucks, carrying cranes and straddle trucks.

**Spray Nozzles.** Binks Mfg. Co., 2122 Carroll Ave., Chicago 12, Ill.—4-page Bulletin 20 contains tables of capacities of each size nozzle at varied pressures.

**Disintegrators.** Rietz Mfg. Co., 441 Folsom St., San Francisco 5, Calif.—Bulletin 501 shows operation by cutaway drawing. Lists specifications of various models.

**Fire Extinguishers.** Ansul Chemical Co., Fire Extinguisher Division, Marinette, Wis.—12-page booklet illustrates line of fire extinguishers. Charts show characteristics and comparative effectiveness of approved equipment.

**Ball Bearings.** General Motors Corp., New Departure Division, Bristol, Conn.—16-page booklet illustrates and describes the use of self-sealed and lubricated-for-life ball bearings designed for belt and trolley conveyors.

**Strainers.** Yarnall-Waring Co., Mermaid Lane, Philadelphia 18, Pa.—4-page Bulletin S-202 describes and illustrates the specifications and operation of a line of strainers.

**Heaters.** Hauck Mfg. Co., 124-136 Tenth St., Brooklyn 15, N. Y.—24-page Catalog 410 discusses an oil burner showing installations in metallurgical, ceramic, glass and chemical plants.

**Clamps.** Hunter Spring Co., c/o R. P. Coleman, 1 Spring Ave., Landale, Pa.—4-page leaflet discusses design and applications of industrial clamp.

**Isopropenyl Acetate.** Tennessee Eastmen Corp., Kingsport, Tenn.—4-page folder contains physical and chemical properties.

**Valve Accessories.** Lunkenheimer Co., Beekman & Waverly Aves., Cincinnati 14, Ohio.—8-page pocket-sized folder illustrates two steel seat ring wrenches.

**Lighting Equipment.** Benjamin Electric Mfg. Co., Des Plaines, Ill.—Guide for selection of proper systems and equipment for industrial lighting installations.

**Fluid Drives.** Link-Belt Co., 307 North Michigan Ave., Chicago 1, Ill.—28-page Catalog 2385 discusses a transmission unit for cushioned starting of machines under varying conditions of loading.

**Welding.** Morton Gregory Corp., Nelson Stud Welding Division, Lorain, Ohio.—18-minute color sound movie entitled "Split-second Fastening." Shows applications of automatic stud welding.

**Custom-Made Equipment.** Hardinge Mfg. Co., 240 Arch St., York, Pa.—12-page Bulletin AS-400 describes this company's plant facilities.

**Mass Spectrometer.** Consolidated Engineering Corp., 620 North Lake Ave., Pasadena 4, Calif.—8-page booklet tells how instrument works, its characteristics and performance, its application to the use and measurement of stable rare isotopes.

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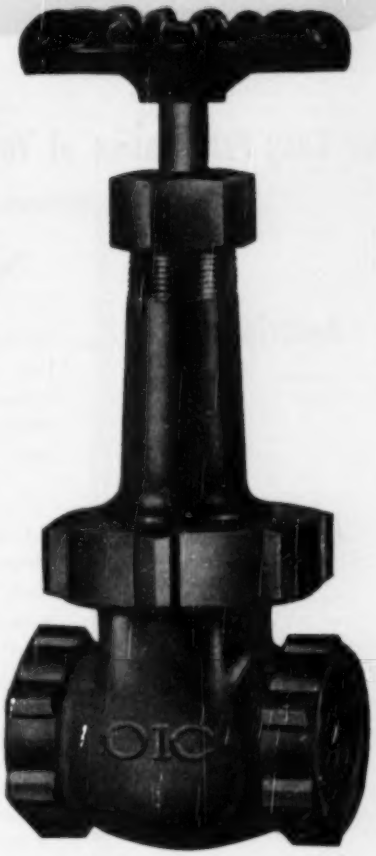
# OIC UNION BONNET BRONZE GATE VALVE




## GIVES YOU MONEY-SAVING FEATURES YOU'LL WELCOME

This series of OIC valves (Figure nos. 7200, 7202 and 7208) is rated for working pressures of 200 pounds steam at 550°F. — 400 pounds water, oil and gas, non-shock. Union bonnet screwed-end type. Solid wedge rising stem, double-disc rising stem and solid wedge non-rising stem designs. Tapered seats and wedges of OIC copper nickel alloy. You'll find this new valve a money-saver on water, oil, gas, steam or any other service where bronze gate valves are used.

### LONGER LIFE—LOWER COST

Scientifically designed, constructed of highest quality materials, accurately machined and thoroughly tested for trouble-free operation.

### EASILY SERVICED—LOWER MAINTENANCE

Easy to dismantle and reassemble. Quick inspection and servicing. Easy repacking.

### EASIER OPERATION—SAVES TIME

Perfect seating without binding or undue wear. Straight-through flow. Minimum pressure drop.

### STRONGER—GREATER SAFETY

Ample wall thicknesses. No dangerous stress concentrations. Leak-proof joints.

OIC
PACE SETTER IN VALVES

### SPECIAL INTRODUCTORY OFFER

If you'd like to check this OIC bronze 200 lb. union bonnet gate valve, simply send us the size and we'll deliver you a sample on memo billing. Inspect it, analyze it, take it apart, test it. At the end of 30 days, if you're not convinced of its superiority over any comparable valve you've ever used, return it for full credit.

**THE OHIO INJECTOR CO.**
265 MAIN ST. WADSWORTH, OHIO

**BRONZE • IRON • CAST STEEL • FORGED STEEL**

# *New* – Vitamin $B_{12}$ Concentrate PFIZER

## for Easy Preparation of Your Own PARENTERAL and ORAL $B_{12}$ Products

| | Parenteral Grade Solids | Oral Grade Solids |
|---|---|---|
| **description** | Slightly hygroscopic material of uniform bulk. Very soluble in water. Essentially pyrogen-free but not sterile. Contains 30,000 micrograms Vitamin $B_{12}$ per gram. | A free-flowing powder of uniform bulk. Non-hygroscopic and reasonably stable in air of average humidity. Contains 500 micrograms $B_{12}$ per gram. |
| **use** | Vitamin $B_{12}$ appears to be the antipernicious anemia factor present in liver, vitally concerned with the formation, maturation and regeneration of red blood cells. Designed for use in the manufacture of sterile solutions of Vitamin $B_{12}$ for parenteral injection. | Continued clinical investigation suggests the requirement of Vitamin $B_{12}$ as a nutritional factor in certain forms of anemia. The oral grade solids is designed particularly as a source of Vitamin $B_{12}$ for the manufacture of oral products. Easily incorporated into tablets and capsules by standard procedures. |
| **supplied** | Designated label potency at least 30,000 micrograms of Vitamin $B_{12}$ per gram according to L.L. assay method. In vials of 1 gram, 500 milligrams, 100 milligrams, 10 milligrams of $B_{12}$ activity. | In vials of 1 gram, 500 milligrams, 100 milligrams, 10 milligrams of $B_{12}$ activity. Vitamin $B_{12}$ potency 500 micrograms per gram according to the L.L. assay method. |

For prices and further information on the preparation of parenteral or oral products with VITAMIN $B_{12}$ CONCENTRATE-PFIZER, please write: Chas. Pfizer & Co., Inc., 630 Flushing Avenue, Brooklyn 6, N. Y.; 425 North Michigan Avenue, Chicago 11, Ill.; 605 Third Street, San Francisco 7, Calif.

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# Chemical Economics

*RICHARD F. WARREN, Market Editor*

## Higher Production Rates Forecast for 1950 in Process Industries

At the start of 1950 optimistic forecasts for the first half of the year were featured in many year-end statements made by chemical executives. Most spokesmen were cautious, however, in discussing the second half of the year. Most seem to feel that there are too many "ifs" to make any concrete predictions on the second half. Nevertheless, many think that if general business holds up at current levels, 1950 will be a better year than 1949 for the chemical process industries.

Among the firms expecting a big year are the synthetic fiber producers. By November the rayon industry was shipping all forms of rayon at a rate that was almost 10 percent above the corresponding 1948 level. It was the second biggest month in the industry's history. A large part of these shipments were made from inventories that were built up during the summer slump. Rayon stocks have now fallen to 23.1 million pounds from a May peak of 70.2 million pounds. Next year's shipments will therefore closely follow production rates.

Rayon staple imports during October rose to 758,000 lb. compared with 251,000 lb. imported in September. However, imports for the first ten months of 1949 totaled only 8,354,000 lb. This is about 25 percent of the 1948 ten-month rate.

Mens' slacks are a fast growing outlet for rayon. Last year use of rayon in this market jumped 22 percent from 1948 levels. The growth is expected to continue this year as a wider variety of fabrics become available, according to the *Rayon Organon*.

Synthetic resin production rose in October as molding materials led the way. Phenolic resins produced for molding were up 2.7 million pounds. Urea and Melamine molding compounds were 1.5 million pounds above the September production rate. Other molding materials that registered substantial gains were styrene type resins, vinyls, cellulosics, acrylics, polyethylene, and nylon.

Sales and inventories in the chemicals and allied products industry classification are attracting considerable interest as a result of the recent readjustments that have been taking place in business. This recent tabulation, based on data collected by the Office of Business Economics, is shown below. The 1949 data are *Chemical Engineering* estimates.

**Chemicals and Allied Products**
**Value of manufacturers' sales and book value of manufacturers' inventories at year end (millions of dollars).**

| Year | Sales | Inventories |
|---|---|---|
| 1938 | ..... | 759 |
| 1939 | 4,339 | 817 |
| 1940 | 4,858 | 875 |
| 1941 | 6,846 | 1,231 |
| 1942 | 7,271 | 1,269 |
| 1943 | 8,809 | 1,390 |
| 1944 | 10,083 | 1,397 |
| 1945 | 10,126 | 1,415 |
| 1946 | 11,028 | 1,828 |
| 1947 | 13,607 | 2,254 |
| 1948 | 14,626 | 2,461 |
| 1949 | 13,600 (est.) | 2,300 (est.) |

Because the pulp and paper industry is one of the major consumers of chemicals, it is always interesting to get a regional breakdown of chemical requirements for this industry. A recent paper presented at the Pacific Chemical Exposition gives a very good breakdown of both productive capacity in Oregon and Clark and Cowlitz Counties of Washington. It was presented by Chester K. Sterrett. The following tables were extracted from it:

| Pulp | 1949 Tonnage |
|---|---|
| Groundwood | 178,850 |
| Sulphite | 493,480 |
| Sulphate or Kraft | 465,375 |
| Total | 1,137,705 |

The following table gives an estimated annual consumption of chemicals to produce this pulp:

| | Tons |
|---|---|
| Sulphur | 75,000 |
| Limestone | 100,000 |
| Lime | 35,000 |
| Salt cake | 40,000 |
| Soda ash | 5,000 |
| Caustic soda | 3,800 |
| Chlorine | 12,500 |

According to data released by the Rubber Manufacturers Assn., October consumption of chemicals in new rubber was 11.4 percent above the September rate. Consumption of natural rubber bounced up to 50,693 long tons, an increase of almost 17 percent. Synthetic consumption rose 3.9 percent in the same interval. Use of reclaimed rubber in October climbed 4.4 percent to 19,227 long tons. However, the over-all use of reclaimed rubber is down 19 percent from the 1948 rate. New rubber consumption is holding up better. For the ten month period it was down about 9 percent from 1948.

The association estimates that the industry consumed about 980,000 long tons of new rubber last year, compared with 1,069,000 long tons used in 1948. Synthetic rubber use, at 410,000 long tons, was proportionately higher in 1949. Consumption of natural rubber was down in spite of a price advantage. A major complaint of the natural rubber dealers and manufacturers was the lack of uniformity in quality, especially in the lower grades of ribbed smoked sheets. American rubber dealers and manufacturers are trying to reestablish standards similar to those set up in 1938. During the year, the government cut the requirements for mandatory use of general purpose synthetic rubber from 223,000 long tons to 162,000 long tons per year. However, as shown above, production ran well ahead of the mandatory requirements.

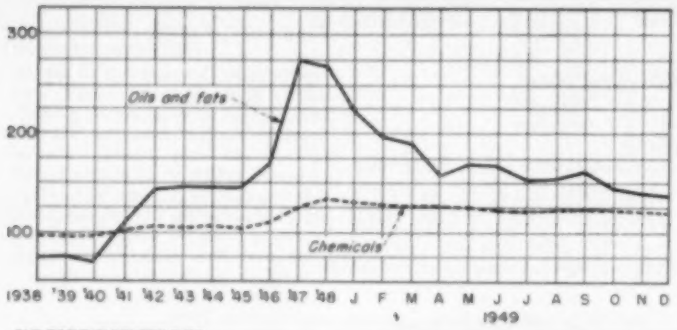
### Price Trends

The price trend was down last year. The *Chemical Engineering* oils & fats price index dropped from 224.33 in January 1949, to 139.92 in January 1950. The average index for the year was 167.41. The *Chemical Engineering* chemical price index followed the same general pattern, but registered a smaller drop. In January 1949, the index stood at 130.47, by the first of this year it was down to 121.24. The annual index number for 1949 was 124.83.

During December the markets were generally quiet and the price structure was generally stable. There was a slight upward movement in some naval stores in the course of the month. Tin chemicals dropped off slightly, reflecting the drop in metal price. During the month some producers raised the price of benzene and toluene.

# *Price, Consumption and Production Trends*

## PRICES

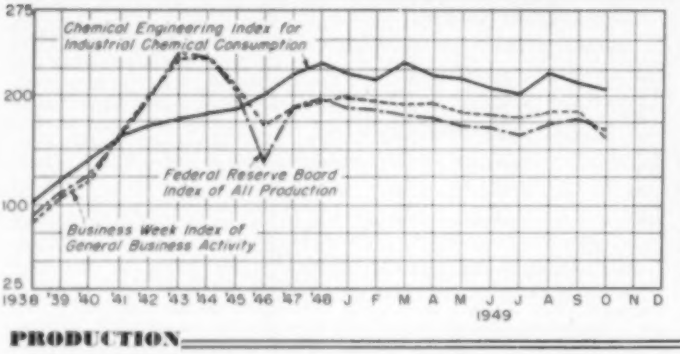



**Chemical Engineering's Price Index**
**A month, a year, and two years ago**

| | Chemicals | Oils & Fats |
|---|---|---|
| As of January 1 ... | 121.24 | 139.92 |
| Last month ..... | 121.16 | 139.42 |
| January 1949 .... | 130.47 | 224.32 |
| January 1948 .... | 127.11 | 293.94 |

1927 = 100

## CONSUMPTION

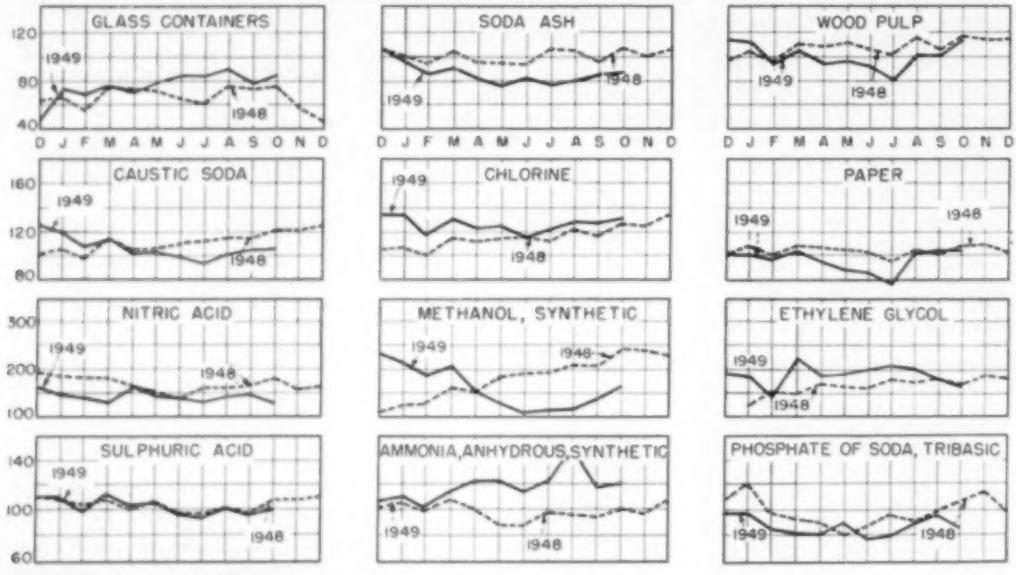

275
200
100
25
Chemical Engineering Index for Industrial Chemical Consumption
Federal Reserve Board Index of All Production
Business Week Index of General Business Activity
1938 '39 '40 '41 '42 '43 '44 '45 '46 '47 '48 J F M A M J J A S O N D
1949

**Chemical Engineering's Consumption Index for Industrial Chemicals**
**(A breakdown by consuming industries)**

| | September (Revised) | October |
|---|---|---|
| Fertilizers ..... | 48.00 | 49.20 |
| Pulp and paper..... | 23.20 | 24.98 |
| Petroleum refining ... | 21.15 | 21.60 |
| Glass ..... | 17.55 | 19.32 |
| Paint and varnish.... | 23.41 | 21.05 |
| Iron and steel..... | 12.10 | 1.68 |
| Rayon ..... | 22.70 | 25.30 |
| Textiles ..... | 9.68 | 11.92 |
| Coal products ..... | 7.10 | 3.02 |
| Leather ..... | 4.42 | 4.29 |
| Explosives ..... | 7.14 | 5.92 |
| Rubber ..... | 4.39 | 4.86 |
| Plastics ..... | 10.35 | 12.09 |
| INDEX ..... | 211.19 | 205.84 |

1935 = 100

## PRODUCTION




100=Monthly Average 1947

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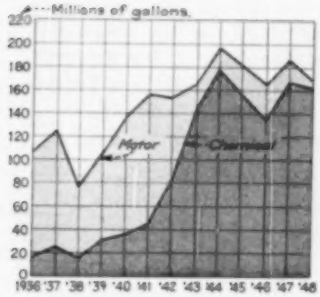
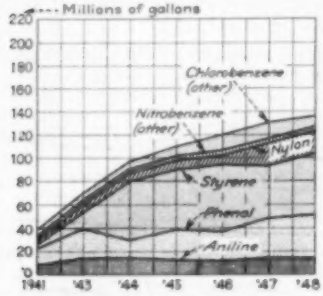
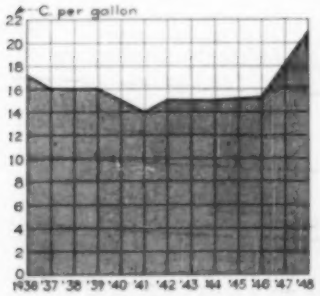
# BENZENE




**PRODUCTION of chemical grades has cut into motor grade output.**




**CONSUMPTION by chemicals shows importance of it in industry.**




**PRICE was dropping before the war, but postwar trend is pointing upward.**

**Rising production has not satisfied the growing demand in recent years, but we may be catching up.**

JOHN R. SKEEN, *Market Research Director, Foster D. Snell, Inc.*

War, strikes, prosperity and the advent of new chemicals have combined to create an inadequate supply of benzene which continues after a decade. Although production of industrial grades rose from 30 million gallons in 1939 to 178 million only five years later, even more was needed. In 1948 the deficit was about 6 percent and it continues into the immediate future as one result of the recent steel strike. While used directly as solvent, gasoline additive, denaturant and in processing, benzene is of greatest importance as a chemical raw material. The major derivatives include aniline, the chlorobenzenes and nitrobenzenes, nylon, phenol and styrene. These find ultimate outlet in every phase of industry: resins, plastics, medicinals, dyes, insecticides, textiles, detergents, explosives. At any time, the urgency of the demand for nearly everything is reflected in benzene.

The extraordinary market was war-induced. First, the armed forces required dyes for textiles, and resins to make protective coatings for new installations. Aniline and phenol were needed. Disintegrating relations with the Japanese made necessary the manufacture of synthetic rubber as well as expansion of the industry. Styrene and diphenylamine became indispensable. Government undertook to export chemicals and phenol was promised to the Russians. By August 1941, the War Production Board amended order M-137 to enforce a shift in the production of motor benzol to chemical grades. This was later followed by complete allocation which also applied to most of the derivatives. Every means of conservation was employed.

Increasing the supply was another matter. Benzene is derived almost entirely from the dry distillation of coal. Byproduct coke ovens are the dominant source. These supply the steel industry with processing coke. For the major part, the amount of benzene depends upon the operations and extent of steel manufacture. With the installation of fractionating equipment, production of the motor grade was reduced. In addition, the completion of over 900 new byproduct ovens was planned and an additional 30 million gallons of pure benzene was anticipated. Finally, all the light oil which could be imported was obtained. Most came from the United Kingdom. As great as was this effort, it was not enough. In 1941, the demand is said to have exceeded the supply by 30 million gallons.

Probably styrene and cumene caused the most trouble. The former continues in importance. For the making of 100-octane aviation gasoline cumene was temporarily needed until the gasoline industry completed its program. The diversion of 70 million gallons of benzene to this use was planned in 1943. Delays occurred and cumene was made throughout the following year, at one time requiring 74 percent of the benzene. Nylon, deriving from adipic acid, was regarded as a military imperative. DDT became a military insecticide. A dozen minor chemicals appeared and the situation, which was already critical, became worse.

Upon the conclusion of hostilities an interval of industrial conversion and expansion followed. The capacities to make phenol and maleic anhydride nearly doubled while nylon tripled, production of aniline increased 20 percent, and styrene continued its new importance. In addition, 50 percent more paradichlorobenzene was made than in war years, benzene hexachloride became a new and important consumer, and 10 million gallons of benzene were required for the new detergents. There appeared to be no limit. For awhile concern was expressed that the supply of benzene would prove inadequate. However, just a few months ago, the demand was declining and a continued drop was feared. This trend has lately reversed. It may be only temporary. In any case, the fortunes of benzene can hardly fail to follow those of the national economy.

(*Continued*)

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## COMMODITY SURVEY, cont. . .

**Benzene Supply and Price Unit: 1,000 gal.**

| | Production [1] Chemical | Production [1] Motor | Foreign Trade [1] Imports | Foreign Trade [1] Exports | Stocks [2] Chemical | Stocks [2] Motor | Recovery in Percent of Light Oil [3] Chemical | Recovery in Percent of Light Oil [3] Motor | Price [4] c/gal. |
|---|---|---|---|---|---|---|---|---|---|
| 1936 | 19,413 | 85,672 | 620 | 16,879 | n.a. | n.a. | 11.8 | 52.2 | 17.2 |
| 1937 | 20,705 | 93,527 | 734 | 20,491 | n.a. | n.a. | 11.9 | 53.5 | 16.0 |
| 1938 | 17,745 | 61,908 | 717 | 10,613 | n.a. | n.a. | 13.1 | 48.1 | 16.0 |
| 1939 | 30,470 | 89,240 | 226 | 12,004 | n.a. | n.a. | 15.4 | 48.6 | 16.0 |
| 1940 | 36,556 | 101,149 | 2,796 | 7,923 | n.a. | n.a. | 15.4 | 48.8 | 15.1 |
| 1941 | 44,812 | 112,508 | ..... | 2,486 | 1,623 | 1,554 | 16.8 | 47.2 | 14.0 |
| 1942 | 85,257 | 68,662 | 5,066 | 187 | 4,978 | 1,790 | 35.3 | 26.8 | 15.0 |
| 1943 | 142,047 | 24,390 | 22,452 | 44 | 3,865 | 1,051 | 53.9 | 8.6 | 15.0 |
| 1944 | 178,393 | 18,557 | 54,679 | 587 | 4,190 | 967 | 56.6 | 7.1 | 15.0 |
| 1946 | 136,353 | 31,827 | 2,280 | 6,010 | 4,850 | 758 | 55.3 | 13.8 | 15.2 |
| 1947 | 167,652 | 19,703 | 1,055 | 1,547 | 7,194 | 610 | 69.1 | 6.5 | 18.5 |
| 1948 | 161,280 | 9,276 | 2,303 | 1,738 | 7,119 | 641 | 61.7 | 3.7 | 20.9 |
| 1949 | | | | | | | | | |
| 1Q | 41,697 | 2,996 | 1,042 | 95 | 8,023 | 716 | | | 21.0 |
| 2Q | 36,171 | 7,287 | 332 | 98 | 6,101 | 824 | (est) 57 | (est) 7 | 21.0 |

[1] Reported by Bureau of Mines and Tariff Commission; see *Information Circular 7604*, June 1949, J. A. De Carlo and J. A. Corgan, also *Facts for Industry*, series 6-2-47 and 6-2-49 for years 1948-49.[2] *U. S. Foreign Commerce and Navigation* — FT 410 and 110, Bureau of the Census. [3] As reported to Bureau of Mines; *Circular 7604*, loc. cit., *Monthly Coke Reports.* [4] Values for early years, courtesy J. A. De Carlo. [5] Bureau of Labor Statistics; "pure," 90 percent nitration, tks.

**Benzene Consumption Unit: million gal.**

| | Aniline from Chloro-benzene | Aniline from Nitro-benzene | Phenol from Chloro-benzene | Phenol from Sulpho-nation | Styrene | Chloro-benzene (other) [1] | Nitro-benzene (other) [1] | Nylon |
|---|---|---|---|---|---|---|---|---|
| 1939 | 1.6 | 4.3 | 4.6 | 2.7 | — | 4.0 | 0.7 | — |
| 1940 | 2.1 | 5.7 | 6.3 | 3.7 | 0.3 | 3.0 | 0.4 | 1.9 |
| 1941 | 2.8 | 7.2 | 8.0 | 4.8 | 0.7 | 3.9 | 1.1 | 2.6 |
| 1942 | 3.8 | 10.3 | 11.0 | 6.6 | — | 5.0 | 0.4 | 11 |
| 1943 | 3.5 | 9.6 | 15.8 | 9.3 | 39.7 | 5.6 | 1.2 | 7.3 |
| 1944 | 3.3 | 9.1 | 15.3 | 8.6 | 49.7 | 5.4 | 1.3 | 7.9 |
| 1945 | 3.3 | 9.0 | 14.4 | 10.9 | 51.4 | 9.2 | 1.1 | — |
| 1946 | 3.3 | 9.0 | 14.6 | 10.9 | 57.6 | 12.5 | 1.0 | 5.0 |
| 1947 | 4.0 | 10.9 | 20.1 | 13.7 | 44.1 | 13.7 | 1.4 | — |
| 1948 | 3.5 | 9.4 | 22.0 | 16.1 | 51.0 | 8.1 | 0.9 | 20 |
| 1949 | | | | | | | | |
| 1Q | 0.7 | 2.0 | 5.1 | 3.8 | 13.0 | 2.6 | — | 3.5 |
| 2Q | 0.6 | 1.7 | 3.9 | 2.9 | 12.5 | 1.6 | — | — |

[1] Calculated from production data reported by Tariff Commission, except for nylon; benzene consumption by process — aniline, phenol — based also upon estimates of capacities by methods over the years. [2] Residual values obtained by difference.

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# DORRCO DOINGS IN 1949

**1949** Again a year of uncertain progress. The definite advances made in Western Europe towards a united democratic government with a declaration of independence in another sector seem overbalanced by changes in Asia. In all they emphasize the conclusion that final peace must come from the heart, and when fear can be cast out, it will come.

At home the wave of enthusiasm brought by the sanity of the Hoover Report in midyear seems overshadowed by the deficit spending and the tight grip on one essential industry of its own dictator. Here again there are signs of revolt, but the fear of mass votes paralizes many.

It has been suggested that the wave of devaluation, a form of lèse majesté in England, and spreading over the world, may have shaken the faith of Europe in Santa Claus.

* * *

**CLASSIFICATION**—Classifiers are being used for desliming and dewatering 1200 tons per hour of ilmenite sands at the unique installation of Humphrey Corp. at Stark, Fla.—entirely water-borne on barges in a dredged pit, placer-fashion. The importance of high specification sand on Federal projects is reflected by the selection of our classifiers, hydroseparators and sizers for preparing concrete sand for the Detroit Dam in Central Oregon, the Hungry Horse Dam in Montana and the Buggs Island and Clark Hill Dams in the Carolinas.

**PAN-AMERICAN JIG**—The jigs of Pan-American Engineering Company, recently acquired and renamed the Dorrco Pan-American placer and pulsator jigs, are well established in placer mining where their operating characteristics indicate their use may be extended into several other fields, such as iron ore beneficiation and the concentration of other minerals.

**CANE SUGAR**—Our orders show that there is a notable and continuing appreciation of Dorr operation and service in the cane sugar world. Factory owners look upon the Dorr Multifeed Cane Juice Clarifier and the Oliver-Campbell Cane Mud Filter as necessary units to help to solve today's high-cost-of-sugar problems.

**SANITATION**—Our type M sewage digester demonstrated at Stamford, Conn. the advantages of rapid mixing of sludge during digestion, and many other cities are now installing units of this improved type. A compact unit for pre-aerating sewage, combining aeration and sedimentation, is still in the development stage but appears most promising.

**FLUOSOLIDS**—The roasting of areseno-pyrite gold ores has been demonstrated by the successful installations at Cochenour Willans and Campbell Red Lake, both in Ontario. Major advantages are easy operation, unusually close control of temperature and sulfur content of the calcine, plus self-roasting with an unusually small amount of sulfur in the feed.

**ABROAD**—In Europe our associated companies in England, The Netherlands, Belgium and France have had a fine year and progress continues in the rehabilitation of the companies in Germany and Italy. Consulting work abroad, done from this country, included a magnesia-from-sea-water project in Norway, copper leaching in the Near East, an aluminum sulfate program in India and continued work in chemical fertilizers. Our far-flung interests have carried members of our domestic staff to all the nations of Western Europe, Norway, Jugoslavia, Cyprus, India, Java, Australia, the Philippines and the Far East.

* * *

Our own year has been an exciting one in many respects. My election to Chairman of the Board with one of my oldest associates, Elmer R. Ramsey, becoming President has strengthened us, and the adoption of our "Tenure Stock" Plan in '48 has served to unite us still further.

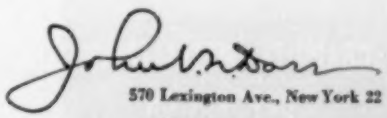
A major undertaking has been the relocation of our General Offices in Stamford, Connecticut, with only an Executive suite with space for "Visiting Firemen", and Eastern Sales Headquarters being retained at 570 Lexington Avenue in New York, where we have been located since 1935. Looking back further, 1913 marks the date of my opening our first New York office with one Engineer.

The completion in November of our first Company film, "The Dorr Way," was a real milestone in our history. Since its mention here last year, final sequences were "shot" from California to New York, and the exacting work of editing 17,000 ft. of film accomplished. The finished film of 1200 ft. necessarily touches most lightly our work in a variety of fields. It is indeed a unique art that can happily compress many years work into 33 minutes, and still give a feeling of drama and continuity.

We have been writing again and have produced, with the greatly appreciated cooperation of many friends around the world, a revision of my book "Cyanidation and Concentration of Gold and Silver Ores," which was brought out by McGraw-Hill in 1936. This is now in the hands of the printer, and will carry the name of Frank L. Bosqui, our Chief Metallurigcal Engineer at Westport, as well as my own. When I started Cyaniding about 1900, his father's recently published book, "The Cyanide Process," was my bible.

Another associate, George D. Van Arsdale, who was for many years with Phelps Dodge and largely responsible for the metallurgical process used at the leaching plant of the Inspiration Copper Company, is compiling and editing for us a book on Base Metal Hydro-Metallurgy. This should reach the printer early in the year.

To our friends and to Dorr staff and associates we send New Year's Greetings and with them an expression of our strong faith in the future.



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- ROTATING SEALS OF GRAPHALLOY ARE UNEXCELLED

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## United States Production of Certain Chemicals

| Chemical (Tons unless otherwise noted) | September 1949 | September 1948 | August 1949 | August 1948 |
|---|---|---|---|---|
| Ammonia, synthetic, anhydrous[1] | 105,443 | 88,062 | 113,994 | 85,556 |
| Ammonium nitrate | 85,906 | 79,942 | 83,253 | 79,223 |
| Ammonium sulphate, synthetic (M lb.) | 133,766 | 29,516 | 92,656 | 14,245 |
| Calcium arsenate (M lb.) | ..... | ..... | 2,960 | 960 |
| Calcium carbide, commercial | 40,286 | 33,194 | 42,009 | 37,445 |
| Carbon dioxide: | | | | |
| Liquid and gas (M lb.) | 20,735 | 24,393 | 20,913 | 26,996 |
| Solid (M lb.) | 74,580 | 70,965 | 105,333 | 93,888 |
| Chlorine | 147,214 | 136,392 | 147,925 | 143,412 |
| Chrome green (M lb.) | 1,284 | 1,153 | 864 | 1,057 |
| Chrome yellow and orange, (C.P.) (M lb.) | ..... | ..... | ..... | 3,403 |
| Hydrochloric acid | 41,030 | 37,525 | 39,709 | 35,782 |
| Hydrogen (M cu. ft.) | 2,231 | 2,209 | 2,270 | 2,402 |
| Molybdate chrome orange, (C.P.) (M lb.) | 317 | 397 | 430 | 334 |
| Nitric acid | 99,721 | 95,370 | 98,308 | 98,318 |
| Oxygen (M cu. ft.) | 1,174 | 1,279 | 1,104 | 1,326 |
| Phosphoric acid (50 percent $H_3PO_4$) | 111,782 | 106,304 | 109,180 | 103,961 |
| Soda ash: | | | | |
| Ammonia-soda process: | | | | |
| Total wet and dry[2] | 317,406 | 287,619 | 305,480 | 294,215 |
| Finished light[3] | 167,902 | 167,340 | 156,930 | 200,857 |
| Finished dense | 115,101 | 133,138 | 111,397 | 137,094 |
| Natural[4] | 16,913 | 24,712 | 16,646 | 26,571 |
| Sodium bicarbonate, refined | 11,980 | 15,276 | 14,334 | 13,903 |
| Sodium bichromate and chromate | 5,552 | 8,200 | 5,575 | 7,785 |
| Sodium hydroxide: | | | | |
| Electrolytic process: | | | | |
| Liquids[5] | 130,685 | 133,920 | 130,373 | 138,434 |
| Solid | 19,657 | 29,206 | 20,120 | 29,993 |
| Lime-soda process: | | | | |
| Liquid[5] | 42,488 | 62,177 | 43,360 | 64,960 |
| Solid | 10,804 | 22,187 | 11,182 | 22,880 |
| Sodium phosphate: | | | | |
| Monobasic | 1,238 | 1,005 | 964 | 1,009 |
| Dibasic | 11,527 | 9,262 | 10,578 | 8,011 |
| Tribasic | 6,580 | 6,596 | 6,332 | 6,172 |
| Meta | 2,438 | 2,452 | 1,941 | 2,905 |
| Tetra | 7,471 | 4,985 | 6,878 | 6,623 |
| Sodium nitrate, anhydrous | 37,180 | 39,232 | 28,284 | 38,085 |
| Sodium sulphate: | | | | |
| Anhydrous | 9,712 | 13,703 | 9,477 | 15,357 |
| Glauber's salt[6] | 12,252 | 14,346 | 12,762 | 14,680 |
| Salt cake[6] | 37,159 | 39,253 | 46,083 | 52,613 |
| Sulphuric acid[6,7] | | | | |
| Chamber process | 212,910 | 210,239 | 210,122 | 238,491 |
| Contact process, new | 578,981 | 801,774 | 609,040 | 609,436 |

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. [1]Includes a small amount of aqua ammonia. [2]Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3]Not including quantities converted to finished dense. [4]Data collected in cooperation with the Bureau of Mines. [5]Figures represent total production of liquid materials, including quantities evaporated to solid caustic and reported as such. [6]Includes oleum grades, excludes spent acid. [7]Data for sulphuric acid manufactured as a byproduct of smelting operations are included.

## United States Production of Synthetic Organic Chemicals

| Chemical | September 1949 | September 1948 | August 1949 | August 1948 |
|---|---|---|---|---|
| Acetanilid | 222,315 | ..... | 288,021 | ..... |
| Acetic acid: | | | | |
| Synthetic[1] | 33,186,080 | 33,476,646 | 29,957,407 | 29,323,834 |
| Recovered | 137,424,830 | 157,673,086 | 117,720,705 | 152,186,343 |
| Natural[2] | 1,001,517 | 1,980,757 | 1,680,294 | 2,301,957 |
| Acetic anhydride[1] | 52,927,350 | 50,239,940 | 50,784,536 | 62,371,131 |
| Acetone | 29,449,374 | 30,317,320 | 27,206,570 | 26,580,643 |
| Acetylsalicylic acid | 813,277 | 1,043,018 | 907,528 | 904,564 |
| Aniline | 5,458,425 | 8,043,016 | 4,143,851 | 7,398,596 |
| Barbituric acid derivatives[3] | | | | |
| 5-Ethyl-5-phenylbarbituric acid and salts (phenobarbital) | 15,208 | 18,178 | ..... | 12,758 |

(Continued on page 276)

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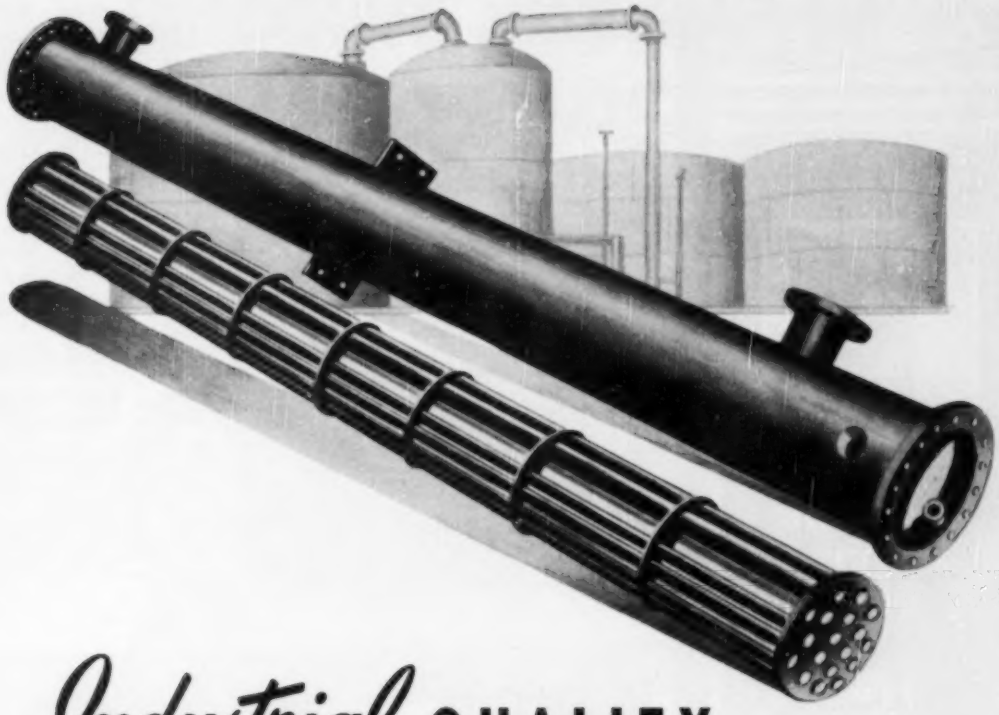

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## U. S. Production of Synthetic Organic Chemicals, cont. from page 274

| Chemical | September 1949 | September 1948 | August 1949 | August 1948 |
|---|---|---|---|---|
| Benzene: | | | | |
| Motor grade: | | | | |
| Coke oven operators[7] | ..... | 660,502 | 1,149,250 | 703,702 |
| All other grades: | | | | |
| Tar distillers[7] | 781,677 | 958,990 | 980,228 | 921,198 |
| Coke oven operators[7] | ..... | 11,966,815 | 10,524,580 | 11,872,577 |
| Butyl alcohol, primary, normal | 10,050,703 | 13,087,430 | 10,127,588 | 11,099,995 |
| Carbon bisulphide | 26,642,539 | 30,091,393 | 28,210,999 | 33,399,130 |
| Carbon tetrachloride | 17,102,129 | 17,377,266 | 16,913,539 | 17,798,101 |
| Chlorobenzene, mono | 18,263,288 | 24,546,803 | 14,984,340 | 25,420,732 |
| Creosote oil: | | | | |
| Tar distillers[8] | 8,352,908 | 9,594,451 | 8,704,103 | 9,527,654 |
| Coke oven operators[8] | ..... | 2,068,711 | 1,201,105 | 2,402,574 |
| Cresols, meta-para | 384,447 | 960,256 | 455,047 | 640,143 |
| Cresols, ortho-meta-para | ..... | 926,204 | ..... | 673,207 |
| Cresylic acid, refined[7,9] | 1,790,605 | 1,713,980 | 1,963,340 | 2,484,341 |
| Dibutyl phthalate | 909,654 | 901,731 | ..... | 1,187,180 |
| Dichlorodiphenyltrichloroethane (DDT) | 3,245,945 | 834,418 | 3,922,676 | 720,769 |
| Ethyl acetate (85 percent) | 5,338,831 | 4,829,833 | 6,423,695 | 5,457,116 |
| Ethylene glycol | 23,367,641 | 32,330,407 | 38,013,457 | 25,708,440 |
| Ethyl ether | 2,547,429 | 3,353,995 | 2,233,626 | 3,060,705 |
| Formaldehyde, 37 percent by wt. | 45,214,925 | 49,565,550 | 43,452,328 | 44,080,417 |
| Hexachlorocyclohexane | 2,734,170 | 1,261,329 | 2,988,502 | 650,085 |
| Methanol, natural | 966,632 | 1,269,774 | 1,043,434 | 1,262,569 |
| Methanol, synthetic | 61,911,135 | 98,789,114 | 53,513,163 | 98,994,905 |
| Naphthalene: | | | | |
| Tar distillers, less than 79° C. | 14,201,257 | 19,695,668 | 10,682,742 | 18,228,160 |
| Tar distillers, 79° C. and over | 5,444,370 | 7,344,346 | 4,376,066 | 6,140,505 |
| Coke-oven operators, less than 79° C. | ..... | 9,863,814 | 5,230,346 | 8,340,173 |
| Penicillin and salts[9] | 11,403,258 | 6,110,790 | 9,915,386 | 7,370,517 |
| Phenol | 12,282,479 | 26,145,105 | 13,968,208 | 25,068,986 |
| Phthalic anhydride | 12,601,994 | 11,011,422 | 10,103,338 | 11,667,426 |
| Styrene, government and private plant | 38,409,486 | 33,310,056 | 34,920,480 | 34,442,949 |
| Toluene: | | | | |
| Coke-oven operators | ..... | 2,366,516 | 2,388,810 | 2,410,160 |
| All other[7] | 2,283,060 | 1,516,523 | 2,025,192 | 2,248,768 |
| Xylene, crude | 3,929,280 | 4,400,565 | 4,495,014 | 4,992,399 |

All data in pounds except benzene (gal.) creosote oil (gal.), toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1]Excludes the statistics on recovered acid. [2]Acid produced by direct process from wood and from calcium acetate. [3]All acetic anhydride including that from acetic by vapor-phase process. [4]Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [5]Statistics are given in terms of bulk medicinals only. [6]Statistics collected by Bureau of Mines. [7]Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8]Reported to U. S. Bureau of the Census. [9]Includes toluene produced from petroleum by any process. [10]Includes refined cresylic acid from petroleum.

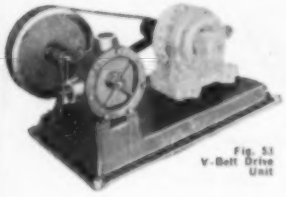

Fig. 53
V-Belt Drive Unit

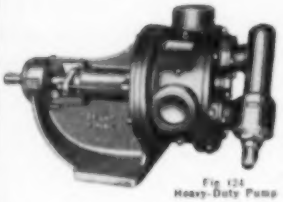

Fig. 124
Heavy-Duty Pump

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# DYNAMIC COMPENSATION

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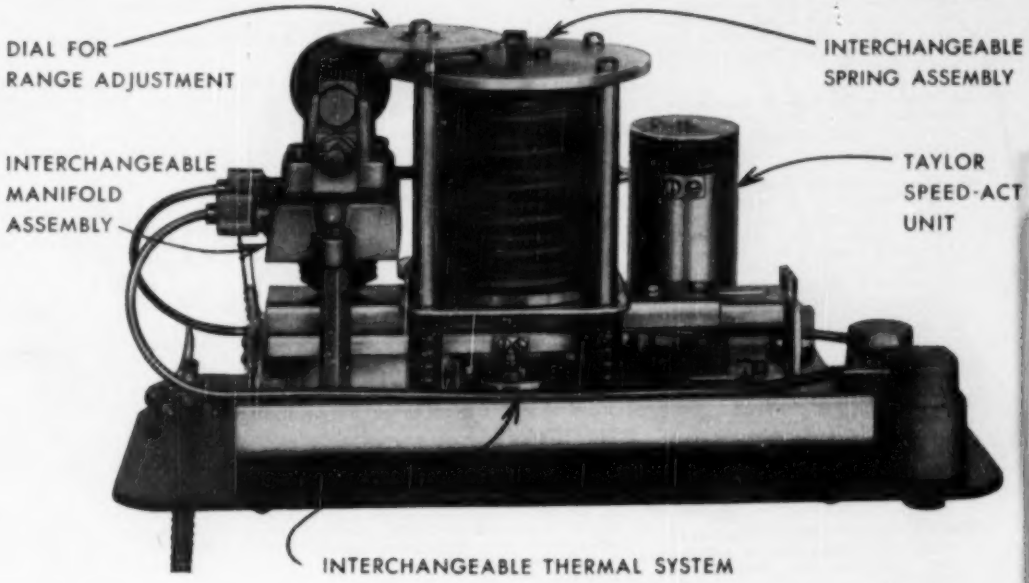


**DYNAMIC ACCURACY** means the accuracy of an instrument in measuring changing or dynamic conditions. Transaire's Dynamic Accuracy is unparalleled. It solves the problem of process engineers who realize that an instrument accurate to a fraction of a degree in measuring static conditions can be in error by many degrees when temperature is changing.

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## TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

# NEW CONSTRUCTION

| | Current Projects | | Cumulative 1949 | |
|---|---|---|---|---|
| | Proposed Work | Contracts | Proposed Work | Contracts |
| New England | ..... | ..... | $274,000 | $1,707,000 |
| Middle Atlantic | ..... | $4,250,000 | 167,203,000 | 24,163,000 |
| South | $893,000 | 4,143,000 | 12,709,000 | 42,508,000 |
| Middle West | 1,607,000 | 983,000 | 29,661,000 | 35,436,000 |
| West of Mississippi | 2,350,000 | 843,000 | 75,748,000 | 109,354,000 |
| Far West | 425,000 | ..... | 17,485,000 | 63,527,000 |
| Canada | 2,975,000 | 3,430,000 | 34,560,000 | 64,948,000 |
| Total | $8,250,000 | $13,699,000 | $336,690,000 | $341,663,000 |

## Proposed Work

Calif., Berkeley—National Canners Assn., 461 Market St., San Francisco, plans to construct a 2 story research laboratory. Wurster, Bernardi & Emmons, 402 Jackson St., San Francisco, Archts. Estimated cost $300,000.

Calif., Vernon—Owens-Illinois Glass Co., Soto and Fruitland Aves., plans to construct a warehouse to contain 62,000 sq. ft. floor space. David R. Edwards, 5911 Pine Ave., Maywood, Calif., Cons. Engr. Estimated cost $135,000.

Ga., Cedartown—Textile Paper Products Co., Cedartown, plans to construct an addition to its paper plant. Estimated cost will exceed $68,000.

O., Venice—Procter & Gamble Co., Gwynne Bldg., Cincinnati, has purchased a 200 acre site here and plans to construct a 2 story research laboratory. Albert Kahn Associated Architects & Engineers, Inc., 945 New Center Bldg. Detroit, Mich., Archts.-Engrs. Estimated cost $1,500,000.

Tenn., Gleason—Nantz & Co., Gleason, plans to rebuild its veneer plant here. Estimated cost $125,000.

Tex., Baytown—Humble Oil & Refining Co., Baytown, plans to reconstruct six of its acid plant units. Estimated cost $200,000.

Tex., Dallas—The Texas Co., 2310 South Lamar St., plans to convert its refinery plant into a products pipe line terminal. Estimated cost $200,000.

Tex., San Antonio—United Gas Pipe Line Co., Alamo Natl. Bldg., plans to construct a new dehydration plant. Estimated cost $450,000.

Tex., Tyler—McMurrey Refining Co., Tyler, plans to construct a fluid catalytic cracking refinery. Universal Oil Products Co., 310 South Michigan Ave., Chicago, Ill., Cons. Engrs. Estimated cost $1,500,000.

W. Va., Fairmont—Owens-Illinois Glass Co., Fairmont, plans to construct a 1 story warehouse. Estimated cost $700,000.

Wis., Milwaukee—The Texas Co., 300 Baker Bldg., Minneapolis, Minn., plans to construct additions to its plant to include 1 story 20x30 ft. foam house, 1 story, 80x174 ft. warehouse, 1 story 46x50 ft. repair shop and 1 story, 10x28 ft. and 10x28 ft. office and truck filling platform. Charles G. Harris c/o Owner, Engr. Estimated cost $196,500.

Alta., Edmonton—British American Oil Co., Ltd., 10622 Jasper Ave., plans to construct a new oil refinery. Estimated cost $1,000,000.

Alta., Hanna—Hanna Petroleum, Ltd., Hanna, plans to construct a plant for the manufacture of natural gas byproducts. Estimated cost $150,000.

Alta., Ogden—Supreme Refineries, Ltd., Ogden, plans to construct an oil refinery. Estimated cost $200,000.

Alta., Red Deer—Melvin Hough Associates, Red Deer, plan to construct a cement plant to have a capacity of 1,500 bbl. daily. Estimated cost $150,000.

B. C., Vancouver—Liquid Carbonic Canadian Corp., Ltd., 2197 West 11th Ave., plans to construct a new plant to produce dry ice and carbonic acid gas. McCarter & Nairne, 1930 Marine Bldg., Archts. Estimated cost $250,000.

Ont., Niagara Falls—North American Cyanamid, Ltd., 1 Fourth Ave., plans to construct an addition to its plant. Estimated cost $125,000.

Sask., Saskatoon—Hi-Way Refineries, Ltd., Saskatoon, plans to construct an addition to its oil refinery. Estimated cost $1,000,000.

Man., Winnipeg—Hobbs Glass, Ltd., 57 York St., Mondon, Ont., plans to construct a factory and office building at 89th St. and 103rd Ave. Estimated cost $100,000.

## Contracts Awarded

Ark., Camden—Magnet Cove Barium Corp., c/o R. N. Reynolds, contractor, Camden, will construct a warehouse and dock facilities. Estimated cost $68,000.

Ill., Bedford—Sun Chemical Corp., 6556 South Malvena St., has awarded the contract for the construction of a chemical plant to Lee Construction Co., 127 North Dearborn St., Chicago. Estimated cost $150,000.

Ill., Chicago—Consolidated Royal Chemical Co., 540 South Wells St., has awarded the contract for a 1 story factory and office building to contain 88,000 sq. ft. floor space, to Jacob Cohen, 52 North Waller St. Estimated cost $500,000.

Ill., Chicago—Des Plaines Waste Paper Co., 508 South Sangamon St., has awarded the contract for a 2 story factory addition to Turnham & Lucht Construction Co., 8552 South Rhodes St. Estimated cost $90,000.

Ill., Chicago—Triangle Tanning Co., 1820 West Webster St., has awarded the contract for an addition to its tannery to Lee Construction Co., 127 Dearborn St. Estimated cost $100,000.

Ill., Deerfield—Kleinschmidt Laboratories, Inc., Waukegan and County Line Rds., has awarded the contract for the construction of a 15,000 sq. ft. factory and office to O & O Construction Co., 20 Green Bay Rd., Winnetka. Estimated cost $75,000.

Miss., Poplarville—American Vegetable Oils Assn., c/o Gotcher Eng. & Mfg. Co., contractor, Clarksdale, will construct an ammonia plant. Estimated cost $68,000.

Pa., Philadelphia—Abbott Laboratories, 1400 Sheridan Ave., have awarded the contract for a warehouse and office building to Robert E. Lamb & Son, Inc., 3429 West Indiana Ave., Philadelphia. Estimated cost $150,000.

Pa., Philadelphia—Gulf Oil Corp., 30th St. and Penrose Ave., has awarded the contract for a marine warehouse and platforms to Hughes-Foulkrod Co., 1505 Race St. Estimated cost will exceed $100,000.

Pa., West Point—Sharpe & Dohme, 640 North Broad St., Philadelphia, has awarded the contract for a 3 story, 95,000 sq. ft. floor space, research laboratory to Henry E. Baton, Inc., 1717 Sansom St., Philadelphia. Estimated cost $4,000,000.

S. C., Williamston—Textron, Inc., c/o Daniel Construction Co., contractor, Greenville, will construct a filament rayon weaving plant here to contain 160,000 sq. ft. floor space. Estimated cost between $3,500,000 and $4,000,000.

Tenn., Humboldt—Federal Chemical Co., Humboldt, will construct an addition to its fertilizer mixing plant. Work will be done by owner. Estimated cost $75,000.

Tex., Dallas—Trinity Portland Cement Co., Republic Bank Bldg., will construct additions to its cement plant. Work will be done by purchase and hire. Estimated cost $300,000.

Tex., Freeport—Dow Chemical Co., Freeport, has awarded the contract for foundation for proposed new ammonia plant to The Austin Co., M & M Bldg., Houston. Estimated cost $475,000. Bids will be taken on plant to cost $4,000,000 in January.

Wis., Kaukauna—Thilamany Pulp & Paper Co., Kaukauna, has awarded the contract for a 1 story, 50x200 ft. addition to its warehouse to Permanent Construction Co., 4100 North Third St., Milwaukee.

Alta., Red Deer—Alberta Independent Refineries, Ltd., Red Deer, has awarded the contract for an oil refinery to Sparling-Davis Co., c/o Owners. Estimated cost $350,000.

Ont., Etobicoke—Farberge Perfumes Canada, Ltd., 689 King St., Toronto, has awarded the contract for a 1 story, 110x110 ft. processing plant here to R. & B. A. Ryan, Ltd., 78 Ligan Ave., Toronto. Estimated cost $100,000.

Ont., Toronto—Pilkington Glass Mfg. Co., Ltd., 19 Mercer St., has awarded the contract for a new glass manufacturing plant to A. W. Robertson, Ltd., 57 Bloor St., W., Toronto. Estimated cost $3,000,000.

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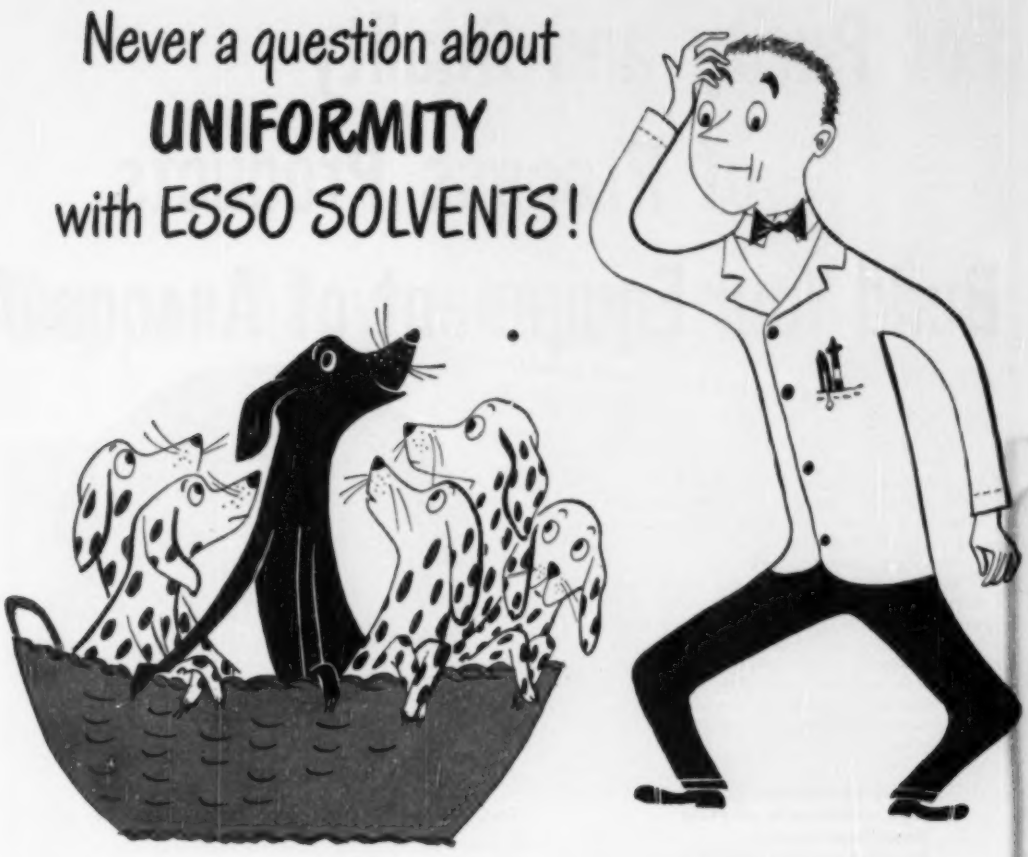

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If you have a solvents problem or want further information on the specifications and characteristics of Esso Solvents—write or call our office nearest you. Our technicians will be glad to assist you.

# For Purity and Quality of Process Products Build Your Equipment of ANACONDA

This process equipment in the Canadian Schenley Limited distillery at Valleyfield, Quebec, is another convincing demonstration of the importance of copper in producing high quality process products.

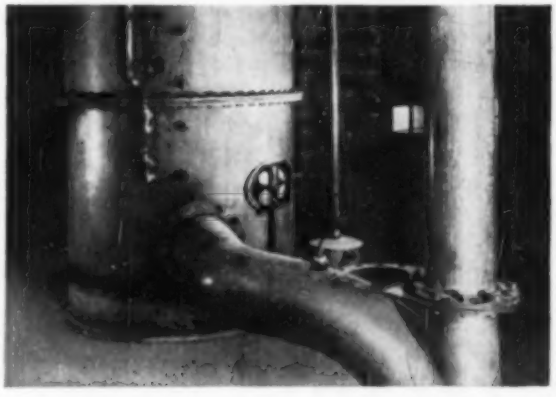
The equipment shown on these pages was fabricated in Canada by Canadian-Vickers Limited, Montreal. ANACONDA Deoxidized Copper was used extensively in its construction because purity and quality are so necessary in producing food products, and because only copper and copper alloys possess this unique combination of properties:

**Ready workability**
**High resistance to corrosion**
**Rapid heat transfer**
**Excellent welding properties**

In addition to ANACONDA Copper Plate, Sheet and Tube for construction, ANACONDA Copper 372 Welding Rod, using the oxyacetylene method, was employed for all copper welds. For high strength combined with high resistance to corrosion, Everdur* Copper-Silicon Alloy was used for bolts in the rectifying column.

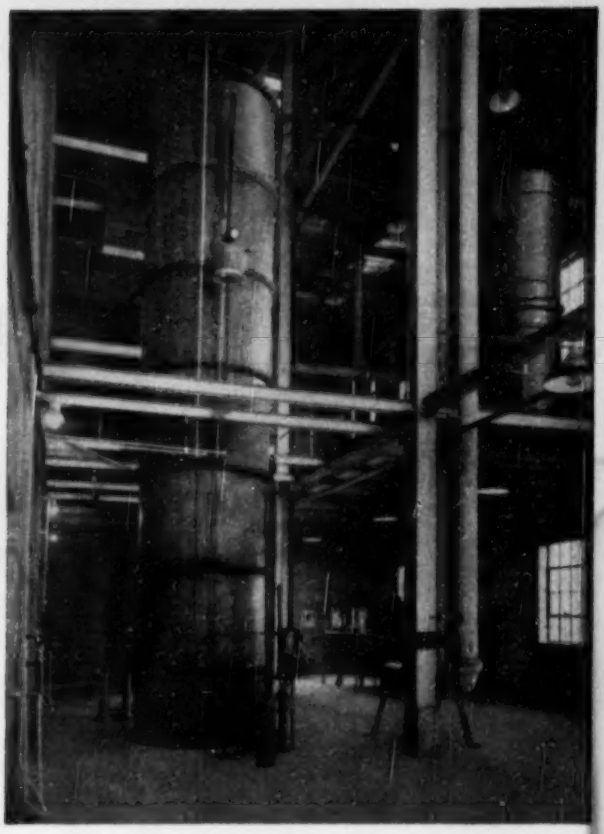
There's no economical, logical substitute for copper and copper alloys where the properties of copper are called for in process equipment. If your products call for freedom from contamination and low production costs, then investigate ANACONDA Copper and Copper Alloys when you design or modernize your equipment. Our Technical Department's broad experience with these metals is yours for the asking. Just write to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Limited, New Toronto, Ont.

**SCALE TANK** manufactured of ANACONDA Deoxidized Cold Rolled Copper tinned on the inside. The sheet forming the bottom belt is 12 Stubs' Gage, the top belt 14 gage and the bottom of the tank 10 gage. The tank is 12 feet in diameter, 15 feet total height. All seams brazed with Tobin Bronze* Rod using oxyacetylene. There are a total of 13 similar tanks, 12 of which are used for storage purposes. Each has a wooden cover which is lined with tinned copper.



## *For copper and its alloys*

# Copper Alloys

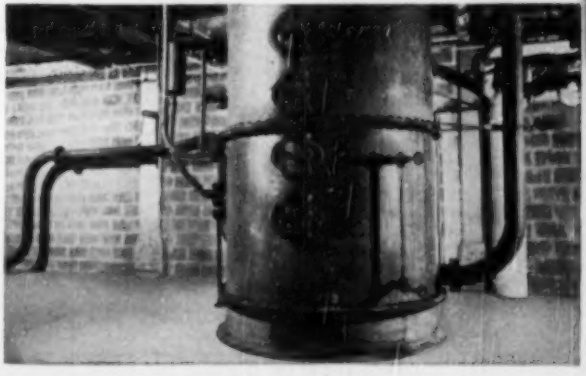


**GENERAL VIEW** of the Canadian Schenley Limited stillhouse showing beer still and condenser. ANACONDA Copper 372 Welding Rod was used to weld the beer still shell seams. Total height from floor about 38 feet. Rectifying column in rear of beer still same dimensions and also of copper. Vapor taken from top by 12 inch copper vapor pipe through beer heater (not shown) to condenser shown at right. The condensate goes to the tail box shown on floor at rear.

**THIS RECTIFYING KETTLE,** installed as a unit, has its dished cover and bottom brazed to the shell, as well as a brazed center joint. All other seams are copper welded with ANACONDA Copper 372 Welding Rod.

←

**BOTTOM SECTION** of 66 inch diameter rectifying column showing vapor inlet piping fabricated from copper sheet. All seams are copper welded. Copper plate and tubing were used to fabricate interior equipment of column. Copper bubble caps are fastened with Everdur Copper-Silicon Alloy bolts.

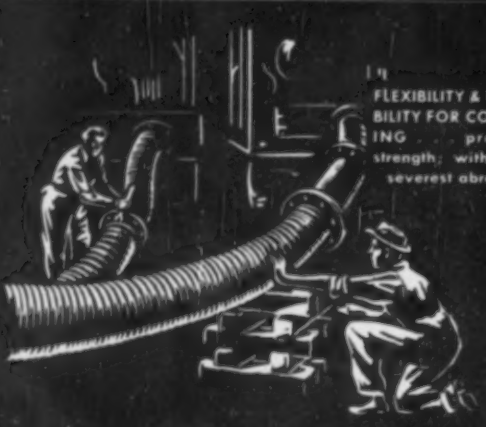


→

**BEER STILL** manufactured of ANACONDA Deoxidized Cold Rolled Copper, .148 inches thick; 72 inch diameter, one seam, all welded with 372 Welding Rod. Inlet and slop discharge piping are 6 inch type "M" copper tube; manhole covers are cast bronze.

## . . . consult ANACONDA

*Reg. U. S. Pat. Off.



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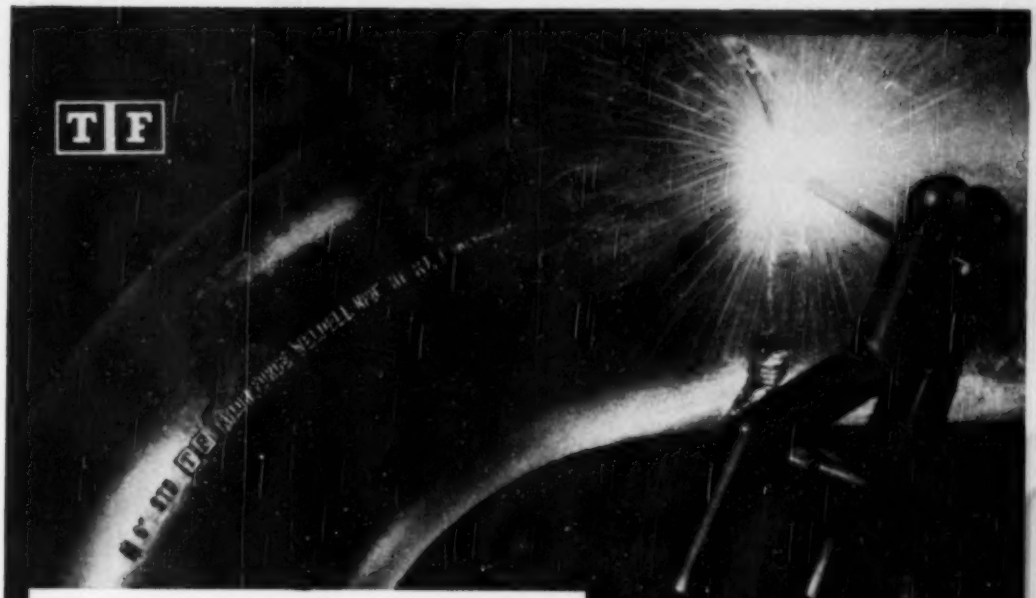

## ...easier and better the WeldELL way

For the *practical* facts about pipe welding fittings go to the *practical* men...the welding foreman; the pipe fitter foreman; the construction superintendent... who have used all kinds and know the field.

They will tell you that the job moves faster and costs stay down when WeldELLS and other Taylor Forge fittings are used

...because of the precision quarter markings, the sized end tangents, the accurate machine tool bevels and lands.

They will tell you that the job maintains momentum easier, smoother

...because of the completeness of the line and better identification markings.

They can tell you...at least, design men will...that the *finished* job is better

...because it is done with fittings that are engineered down to the last detail to meet all requirements of *every job*.

Yes, "WeldELLS have everything"...to make it *easier ...better*. Coupon brings lots of facts.

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*Mail to Taylor Forge & Pipe Works*
*P.O. Box 485, Chicago 90, Ill.*

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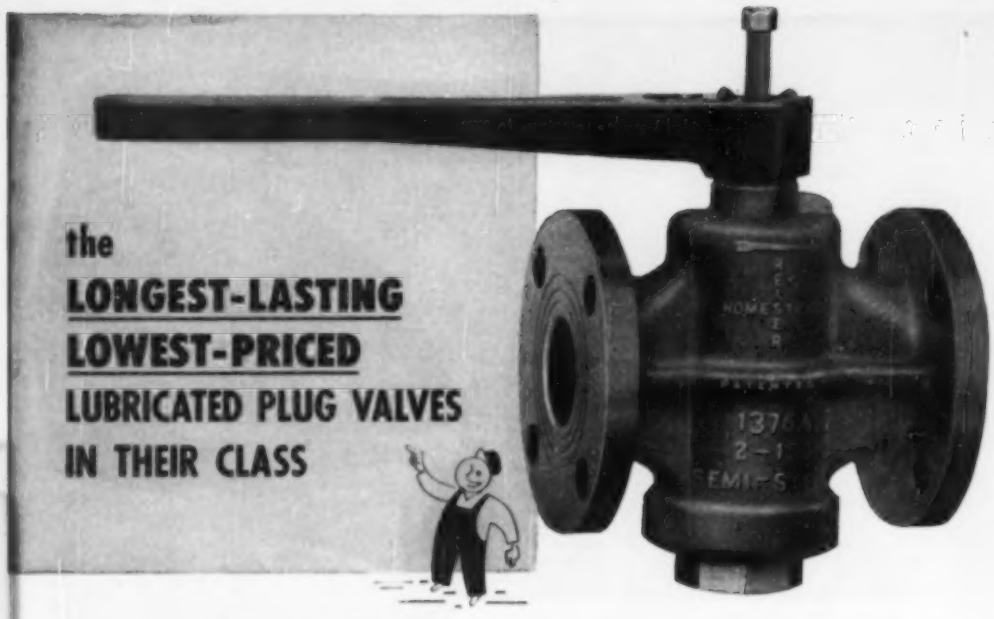
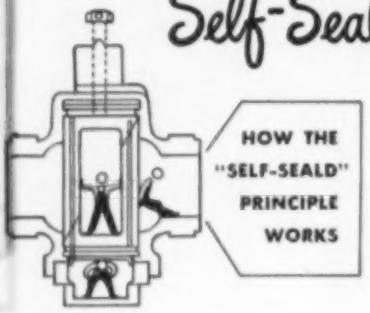



# HOMESTEAD-REISER

## *Self-Sealed* LUBRICATED PLUG VALVES




In addition to a full lubricant seal around the ports and around the top and bottom of the valve, the wedge-action of the plug under line pressure, constantly presses the finely-finished surfaces of the plug outward against the seating surfaces of the body. This self-sealing action keeps the plug surfaces in contact at all times with the mirror-like bore of the body. The plug thus automatically adjusts itself for wear, assuring extra long life and maximum leakless service.

In both screwed and flanged types, Homestead-Reiser Valves are the lowest-priced, full-port-area valves in the 200 lb. oil-water-gas, 150 lb. steam working pressure class.

**They provide:**

- **100% area of standard pipe**
- **100% lubricant seal around ports**
- **Patented "Self-Sealed" Principle with *automatic adjustment for wear***
- **Single lubricant for wide variety of applications**
- **Extreme economy of lubricant**

We designed and built Homestead-Reiser Valves to outlast all other lubricated plug valves in their class. Their ability to do so, and their superior performance in service, have been established in practically every industry during the past seven years.

*For full details write for Catalog 39—Section 5*

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*"Serving Since 1892"*

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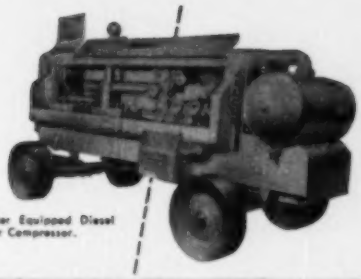
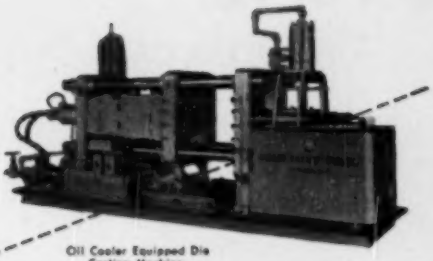


Oil Cooler Equipped Diesel Air Compressor.



Oil Cooler Equipped Die Casting Machine.

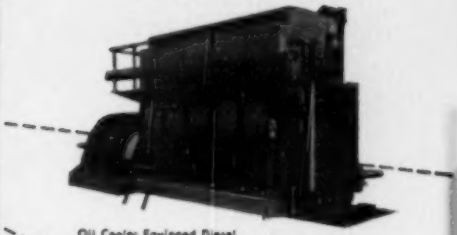
*IN STOCK UNITS OR HIGHLY SPECIALIZED DESIGNS*

# ROSS STANDARDIZATION

## BRINGS TIME-SAVING, COST-SAVING BENEFITS

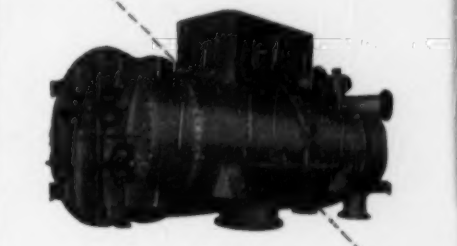
As both machinery manufacturers and users well know, Ross' complete standardization and mass production of smaller size exchangers enable the immediate shipment of many units from stock and the immediate assembly of many others from stocked parts. The net result is extensive use of Ross exchangers as original accessories by the Diesel, hydraulic machinery and like industries.

But the time-saving, cost-saving benefits of Ross standardization are not limited to size and type. Many apply to even the most specialized of custom-engineered exchangers. For having completely standardized and carefully classified all essential components of such larger, more complex equipment as power plant surface condensers, refinery heat exchangers*, high pressure bleeder heaters or mammoth fuel oil heaters . . . Ross can eliminate many of the engineering and fabricating costs and delays commonly associated with specially engineered units.



Oil Cooler Equipped Diesel.

High Pressure Bleeder Heater.



Surface Condenser.

* Ross refinery type heat exchangers conform thermally and mechanically to standards of Tubular Exchanger Manufacturers Assn. of which Ross is a member.

ROSS

**EXCHANGERS** . . . *MAKE OTHER PRODUCTS BETTER*

As part of your program for greater plantwide productivity, it would be to your advantage to be familiar with the full details of cost-reducing, time-reducing Ross standardization. Write.

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*Serving home and industry*

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## Announces a New Series of

## *Saturated Fatty Acids of Unusual Chemical Purity*

**HYSTRENE* S-97** (97% Stearic Acid)

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***Made possible by a new and unique solvent purification method.***

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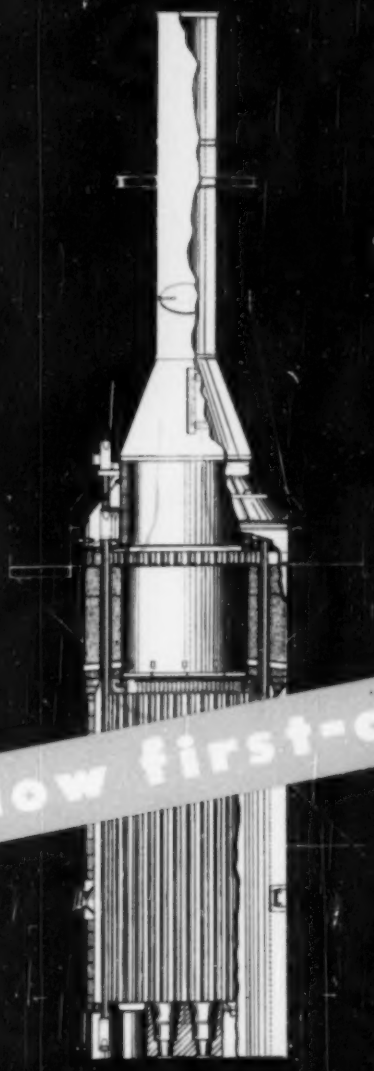

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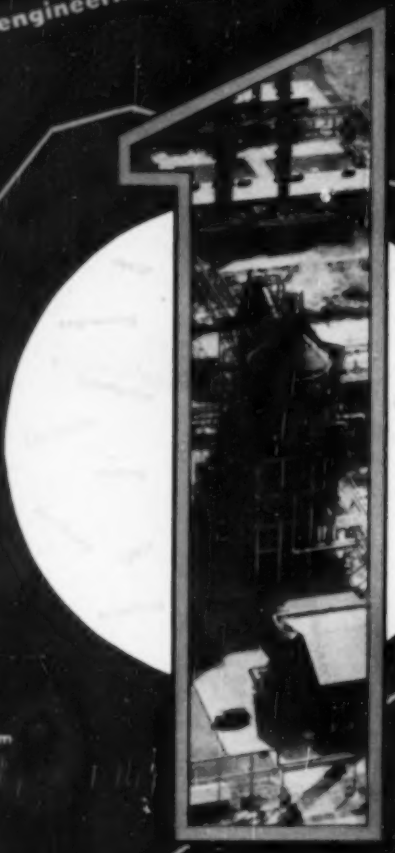

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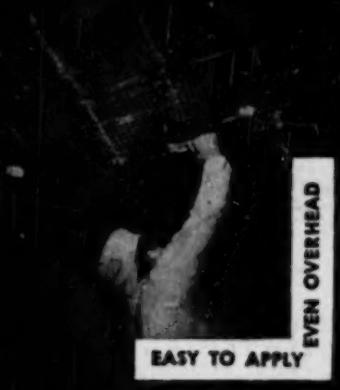
**"EVERY WORKING DAY OF HEAT LOSS *ANYWHERE* IN YOUR PLANT IS WORKING CAPITAL LOST"**

# B-H POWERHOUSE CEMENT... the new finishing cement that insulates




**B-H POWERHOUSE CEMENT** saves time, cuts costs—a one-coat application trowelled to required thickness in a single operation. Moreover, this new mineral-wool-base finishing cement takes a hydraulic set within two hours.

Its smooth hard finish is paintable. An attractive inside finish can be obtained with any paint. Outside, B-H Weatherseal gives permanent protection.

Easy on labor, easy on budget, B-H Powerhouse is the ideal *finishing-insulating* cement for industrial equipment. For full information and free sample, fill out the coupon.

**Baldwin-Hill Company**
**701 Breunig Avenue**
**Trenton 2, N. J.**

Please send me complete information on B-H Powerhouse Cement.

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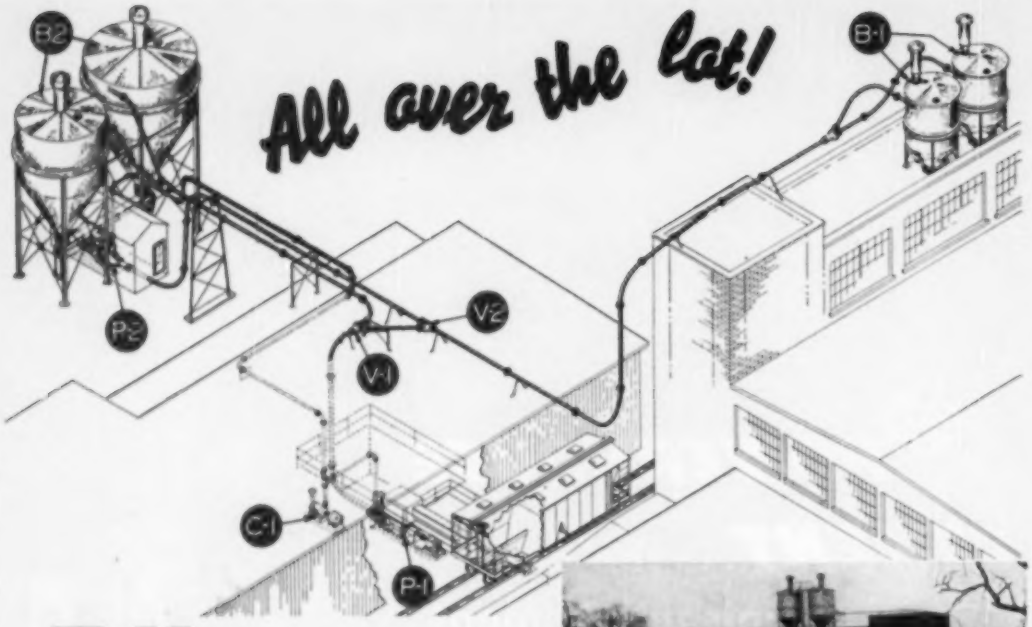


# F-K SYSTEMS

## DOING AN EFFICIENT MATERIAL-HANDLING JOB

The Fuller-Kinyon Systems, illustrated by the drawing above, are used for unloading, conveying and reclaiming Portland cement and filler dust in an asbestos shingle plant. Installed in an existing plant, these systems were designed and built to service process equipment already installed, and provide for future expansion.

"All over the lot" conveying, that's virtually what happens to the materials handled by the Fuller-Kinyon Systems in this plant. Through the simplicity and flexibility of these systems, materials are unloaded (P-1), from hopper-bottom cars to a Fuller-Kinyon Pump, and conveyed, through the use of two-way diverting valves (V-1 and V-2), direct to process bins (B-1), or to reserve storage bins (B-2). A second Pump (P-2), conveys materials from the storage bins (B-2), to process bins (B-1). A very flexible and simple system, economically possible only with Fuller-Kinyon.

A Fuller Rotary Single-stage Compressor (C-1), furnishes air for both conveying systems, capacity 282 c.f.m., 25-lb. pressure. Air, where and when needed, and at the right pressure to do the work most economically and efficiently.

**WE BUILD**

FULLER-KINYON CONVEYING SYSTEMS
F-H AIRSLIDE CONVEYOR
FULLER-FLUXO CONVEYING SYSTEM
THE AIRVEYOR
ROTARY COMPRESSORS AND VACUUM PUMPS
INCLINED-GRATE COOLERS
DRY PULVERIZED-MATERIAL COOLER
ROTARY FEEDERS AND ROTARY VALVES
MATERIAL-LEVEL INDICATORS
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P-183

**Fuller**

**ENGINEERS AND BUILDERS OF MATERIAL-HANDLING SYSTEMS**

# HEAT IMPRISONED

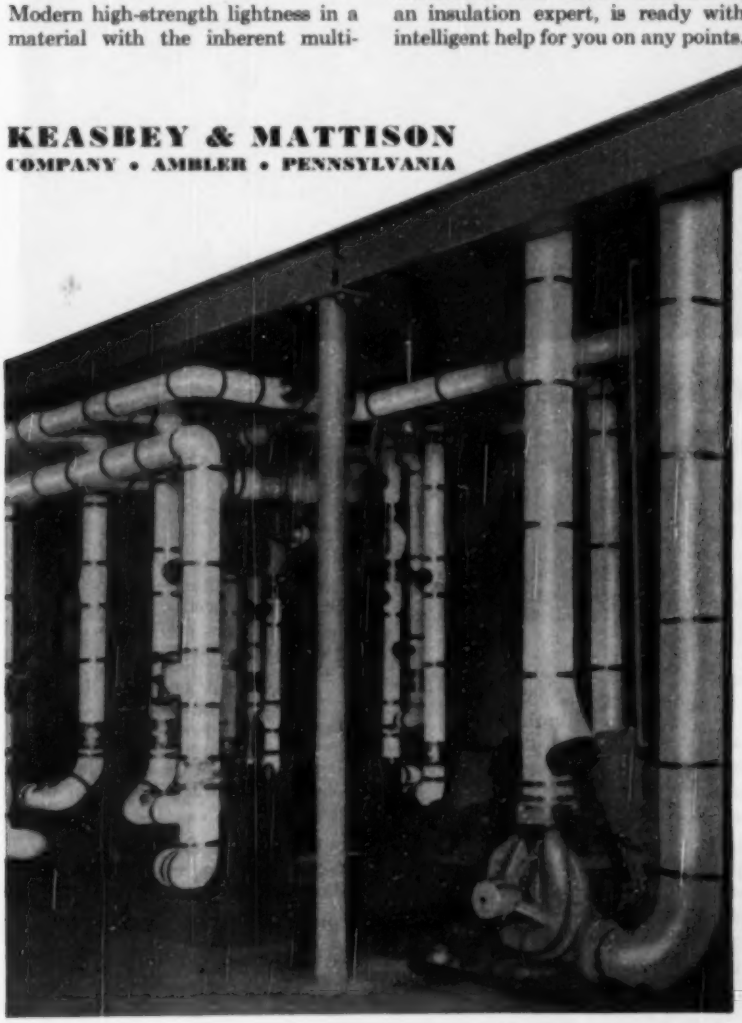
## BY K&M "FEATHERWEIGHT" 85% MAGNESIA PIPE INSULATION

The fuel dollars, the power dollars, the production dollars, are what cannot escape at will, where K&M "Featherweight" Insulation imprisons the heat. K&M "Featherweight" cuts, fits and handles without waste effort and material. Maintenance expense is warded off, too, by the high physical strength of "Featherweight" and by its resistance to adverse atmospheric factors.

Modern high-strength lightness in a material with the inherent multi-cellular structure to keep heat in its place, is achieved by the K&M way of correctly compounding clean Asbestos Fibre with basic Carbonate of Magnesia.

Temperatures to 600° F don't overtax K&M 85% Magnesia Insulation. You can get it in all standard dimensions. You'll get assured economies, as with all the other K&M insulation materials. Your K&M Distributor, an insulation expert, is ready with intelligent help for you on any points.

**KEASBEY & MATTISON**
**COMPANY • AMBLER • PENNSYLVANIA**



**HANDSOME DOES AS HANDSOME IS IN THE PLANT OF J & J CORRUGATED BOX CO., Fall River, Mass.**

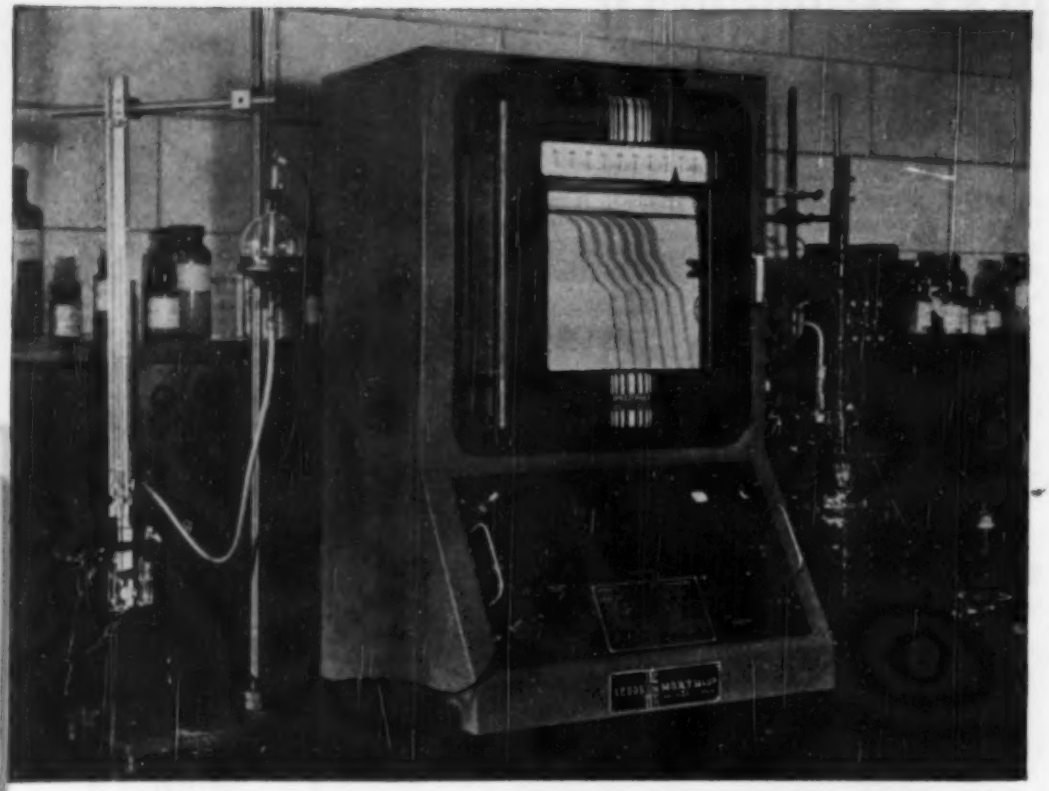
**INSULATION CONTRACTOR:** *Armstrong Cork Co.*

*Standard thick K & M "Featherweight" with canvas jackets, on all piping.*

*K & M 85% Magnesia Blocks on all flanges, with cement and canvas jacket finish.*

*K & M Asbestos Cement and canvas jacket finish, on all fittings.*

K&M best in asbestos



# Fast, precise polarographic analysis with new Type E Electro-Chemograph

Designed for rapid, accurate polarographic analysis, the new L&N Type E Electro-Chemograph features one-piece console design incorporating a built-in Speedomax Recorder. Exceptionally flexible and stable, the instrument is convenient for both research and industrial process control laboratories.

Like the previous model of this L&N equipment, the Electro-Chemograph automatically plots diffusion current as a function of voltage. Now, however, the data-taking is done by a Speedomax Microampere Recorder, which provides greater speed of analysis and more complete detail of test results. A typical test run can now be made in about half the previous time.

A full range of variation in test technique is available through a set of controls, all centralized on one panel. Step-by-step instructions for operation, testing and calibration are included on the front of the instrument.

Choice of four degrees of damping enables the user to obtain a record that presents qualitative and quantitative data in the desired detail. Eleven current ranges cover full-scale readings of 1, 2, 3, 5, 7, 10, 15, 20, 30, 50 and 100 microamperes.

There are three polarizing voltage ranges: 0 to −2, −1 to −3 and +1 to −1 volts. To cover both anodic and cathodic polarization, any of these ranges can be reversed in polarity. Time to run through a polarizing range is ten minutes. Voltage can be adjusted to ±4 mv by calibration against an integrally-mounted standard cell.

When it is desirable to obtain several different diffusion current curves on the same chart for inter-comparison, the recorder zero can be readily shifted to separate the individual curves.

The equipment is shielded against electrical pick-up, and is not affected by vibration. Normally it is supplied for a-c operation, but it can be supplied for use with a battery for the polarizer.

For further details, write to Leeds & Northrup Company, 4916 Stenton Avenue, Philadelphia 44, Pa.

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HEAT-TREATING FURNACES

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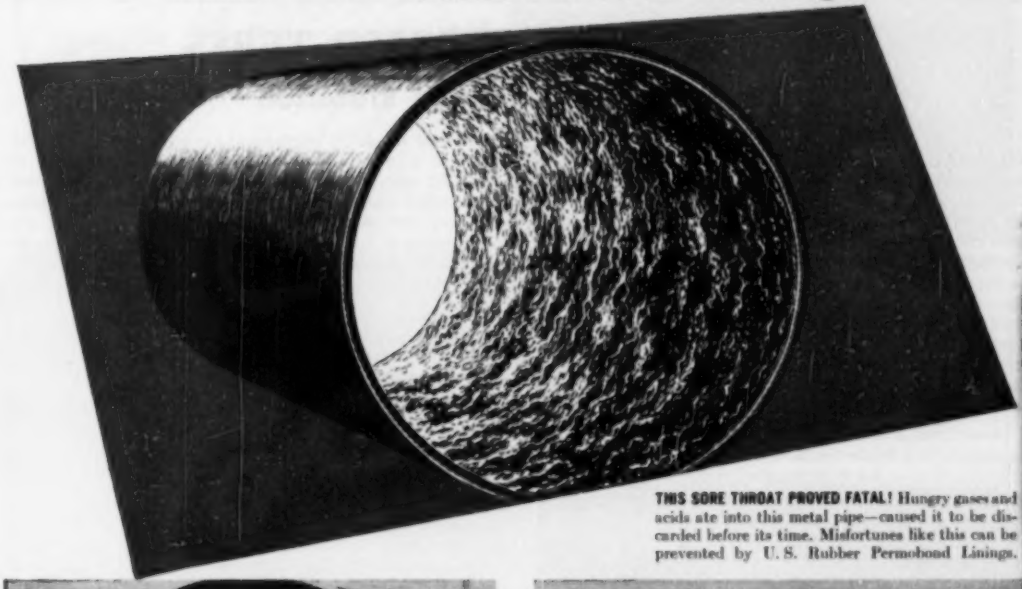
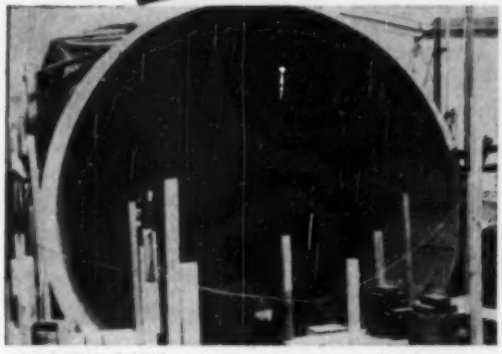
# PIPE KILLERS FOILED!

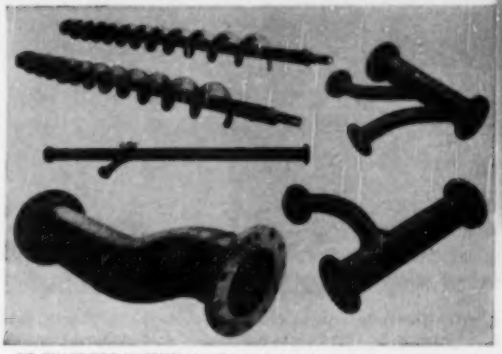
## Gases and acids no longer chew up interiors of pipes —thanks to U. S. Rubber's Permobond Linings



**THIS SORE THROAT PROVED FATAL!** Hungry gases and acids ate into this metal pipe—caused it to be discarded before its time. Misfortunes like this can be prevented by U. S. Rubber Permobond Linings.



**GIANT METAL THROAT** is 27 feet in diameter, 108 feet long. Its protective lining of Permobond, installed right on the job, nullifies the corrosive action of acids, gases, chemicals and solutions.



**NO SHAPE TOO UNUSUAL** for Permobond. It is impermeable, and can be bonded and applied to almost any fabricated metal section, big or small, simple or complex, by our skilled craftsmen.

What's your particular corrosion problem? Our engineers will gladly discuss it with you. Very often these men can install and thoroughly vulcanize Permobond to existing equipment in your own plant. For full information write Mechanical Goods Division.

A PRODUCT OF

U.S. RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

ROCKEFELLER CENTER, NEW YORK 20, N. Y.

# COPPER ALLOY BULLETIN

**CONDENSER AND HEAT EXCHANGER TUBING EDITION**

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

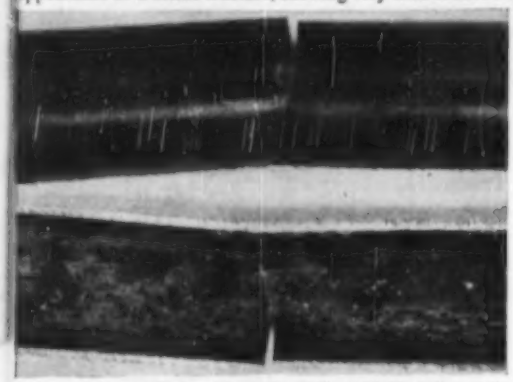
*Prepared Each Month by BRIDGEPORT BRASS COMPANY* "Bridgeport" *Headquarters for BRASS, BRONZE and COPPER*


## CRACKING OF CONDENSER TUBES

### Influenced by Excessive Vibration

Sometimes examination of leaking condenser tubes shows that they have failed from transverse cracks close to the tube sheet or midway between tube supports. Closer examination frequently reveals the presence of abrasion marks on the outside of the tubes, about midway between tube supports. Sometimes deep abrasion marks will be found in that section of the tube in contact with the support sheet. Those tubes which face the incoming stream may show some roughening of their outside surface. When water, or petroleum products containing brine are carried inside the tubes, examination of the interior reveals, after removal of corrosion products, a few, up to several hundred, fine transverse cracks which have not perforated the tube. Deep, hemispherical corrosion pits may also be found in the affected area.

Microscopic examination discloses that the cracks have the appearance of a brittle fracture, showing very little reduction



Corrosion fatigue crack viewed from the outside and inside surface of the same condenser tube.

of cross-sectional area. If corrosion is not far advanced, the fracture may be very bright and coarsely crystalline. Careful laboratory examination of such tubes and study of operating data have shown that these are the symptoms of cracking resulting from excessive vibration of the condenser tube.

**Fatigue Cracking Through Vibration.** It has been established that when a tube is repeatedly flexed back and forth with sufficient severity for a long period of time, it will fail from fatigue cracking. The combined action of corrosion and vibration leads to more rapid development of cracks in condenser tubes.

The effect of corrosion in accelerating fatigue cracking of tubing is apparently due to roughening of the surface. A roughened surface is often more subject to lowered fatigue life than a smooth surface. The flexing back and forth of vibrating tubes presumably injures the protective film and, at the points where this occurs, cracking develops. It has been observed that deep, hemispherically-shaped corrosion pits also develop in this area to a greater extent than elsewhere on the tube surface. For example, at the points of least vibration, this type of pitting is scarcely discernible.

Corrosion fatigue cracking is generally confined only to a relatively small number of tubes in a condenser or heat exchanger, because only a few tubes in the unit may be responsive to the type of vibration present.

Corrosion fatigue cracking is most prevalent where corrosive waters are encountered such as in plants using harbor waters polluted by various types of wastes. In plants using clean, fresh water relatively little trouble from corrosion-fatigue has been called to our attention.

**Sources of Vibration.** Pulsating streams of liquids or gases striking the tubes at high velocities frequently start tubes vibrating. Sometimes vibration of compressors, pumps, and adjacent equipment may start some of the tubes vibrating. Where the pulsation is the same as the resonant frequency of the tubes, the extent of vibration developed in the tubes is surprisingly great and is the primary cause of this type of failure.

**Preventing Excessive Vibration.** Condenser designers have come a long way toward keeping this type of difficulty to a minimum. In some old installations, excessive vibration has been greatly reduced by using more tube support sheets. Where that may not be practical, good results have been obtained by wedging pieces of flattened tubing between the rows of tubes affected. In other cases, vibration has been reduced by making sure that all equipment is running smoothly, and by avoiding critical operating speeds of turbines, pumps, compressors, and motors.

**Choosing the Best Alloy.** Operating conditions are becoming more complicated and severe. While Admiralty gives excellent service under many conditions, the possibilities of other alloys, such as Arsenical Muntz, Aluminum Brass, Cupro Nickel, Red Brass, Copper and combinations of these metals with steel, and stainless aluminum, etc., in the form of Duplex Tubing, should be considered.

Contact the nearest Bridgeport office for service, and write for the 120-page Condenser Tube Manual, containing many helpful facts concerning condenser tube applications in various industries, as well as data on condenser tube alloys, corrosion, methods of installing, specifications and other usual facts.

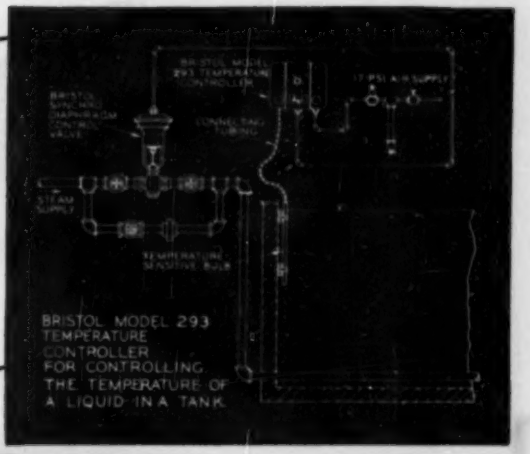
*Reg. U. S. Pat. Off. 2093380

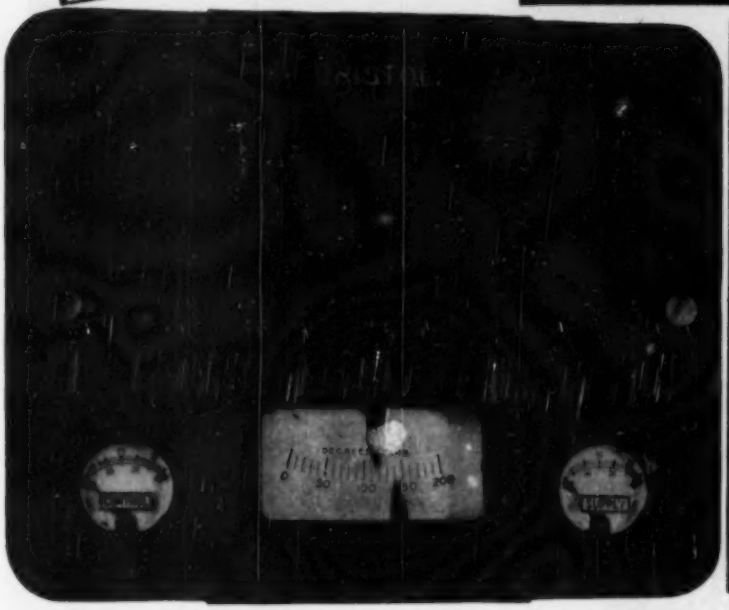

**BRIDGEPORT BRASS**

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • *ESTABLISHED 1865*

*Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal*

# WHERE VARIABLES *must be controlled* BUT NOT NECESSARILY *recorded*



## *Here* ARE THE VARIABLES THE MODEL 93 CAN CONTROL

***Temperatures***
from −125° to 1000°F.

***Pressures***
from full vacuum to 4000 psi.

***Liquid Level***
in open or closed vessels.

***Humidity***
from 0 to 100% R. H.

***Flow***
of steam, gas, air and liquids through pipes.

Bristol's new Model 93 Air-operated Controllers are designed for those cases where you want variables put under accurate control, but where chart records are either not required or are otherwise provided for.

Model 93 is a small, compact, simple instrument having a precision measuring element and Bristol's Free-Vane Control—the frictionless system which is the most accurate of all air-operated designs. You get an absolutely true visual indication of results.

***A new bulletin, No. A115, gives complete details. Write for a free copy to 109 Bristol Road, Waterbury 91, Conn.***

**THE BRISTOL COMPANY, WATERBURY 91, CONNECTICUT**

The Bristol Co. of Canada, Ltd., Toronto, Ontario
Bristol's Instrument Co., Ltd., Lynch Lane, Weymouth, Dorset, England

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*Engineers Process Control for Better Products and Profits*

**AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS**

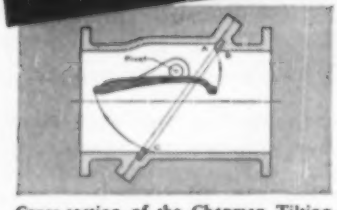
# SAVE UP TO 80% IN HEAD LOSSES

## with CHAPMAN TILTING-DISC CHECK VALVES

That's right! With Chapman Tilting-Disc Valves, head losses are 65% to 80% lower than for conventional type check valves.

But no wonder head losses are lower. Chapman Check Valves work with . . . not against . . . the stream. The balanced disc rides smoothly on the flow . . . lifts away easily in opening and closes quickly and quietly. There's no slamming to cause destructive pipe line stresses . . . minimum wear on seats, hinge pins and bearings.

All these features mean lower maintenance costs for you. So write *today* for additional information.



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

**The Chapman Valve Mfg. Co.**
INDIAN ORCHARD, MASSACHUSETTS

Barrett

# "ELASTEX"

## PLASTICIZERS

**BARRETT "ELASTEX" DCHP PLASTICIZER**
(Dicyclohexyl Phthalate)

| | |
|---|---|
| Color | White |
| Form | Granular solid |
| Odor | Mild, characteristic |
| Acidity (as Phthalic Acid), % | 0.01 Maximum |
| Ester content, % by weight | 99.0 Minimum |
| Melting Point, °C | 62-65 |
| Containers | Fibre drums containing approximately 250 pounds net. |

**BARRETT "ELASTEX" 10-P PLASTICIZER**
(Diisooctyl Phthalate)

| | |
|---|---|
| Color | 50 Hazen, Maximum |
| Form | Clear liquid |
| Odor | Mild, characteristic |
| Acidity (as Phthalic Acid), % | 0.01 Maximum |
| Specific Gravity, 20/20°C. | 0.983 to 0.987 |
| Saponification Number | 280-290 |
| Cloud test | Clear at 0°C. |
| Containers | 50-55 gal. non-returnable steel barrels. |

**BARRETT "ELASTEX" 50-B PLASTICIZER**

| | |
|---|---|
| Color | 80 Hazen, Maximum |
| Form | Clear liquid |
| Odor | Mild, characteristic |
| Distillation at 5 mm. Hg, °C. | 189-222 |
| Specific Gravity, 20/20°C. | 1.075 to 1.081 |
| Acidity (as Phthalic Acid), % | 0.01 Maximum |
| Saponification Number | 364-374 |
| Containers | 50-55 gal. non-returnable steel barrels. |

**BARRETT "ELASTEX" 28-P PLASTICIZER**
(Dioctyl Phthalate)

| | |
|---|---|
| Color | 50 Hazen, Maximum |
| Form | Clear liquid |
| Odor | Mild, characteristic |
| Acidity (as Phthalic Acid), % | 0.01 Maximum |
| Specific Gravity, 20/20°C. | 0.983 to 0.989 |
| Ester Content, % by weight | 99.0 Minimum |
| Cloud test | Clear at 0°C. |
| Containers | 50-55 gal. non-returnable steel barrels. |

**BARRETT* CHEMICALS**

*Available*

**TO THE PLASTICS INDUSTRY**

Dibutyl Phthalate
"ELASTEX" DCHP Plasticizer
"ELASTEX" 10-P Plasticizer
"ELASTEX" 50-B Plasticizer
"ELASTEX" 28-P Plasticizer
Phthalic Anhydride
Phenol
Cresols
Cresylic Acids
Toluol

Barrett

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5551 St. Hubert St., Montreal, Que.
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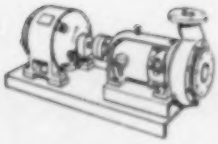
THREE REASONS WHY THEY'LL GIVE YOU BETTER SERVICE . . .



# ❶ I-R Chemical Pumps are Built for Easy Maintenance — and less of it

These pumps are ruggedly constructed to last longer on the job — and the simple design, with all parts easily accessible, means less "time out" for maintenance. Here are just a few of the many I-R features that add up to maximum performance, minimum maintenance, and high operating efficiency. For complete details, contact your nearest I-R engineer.

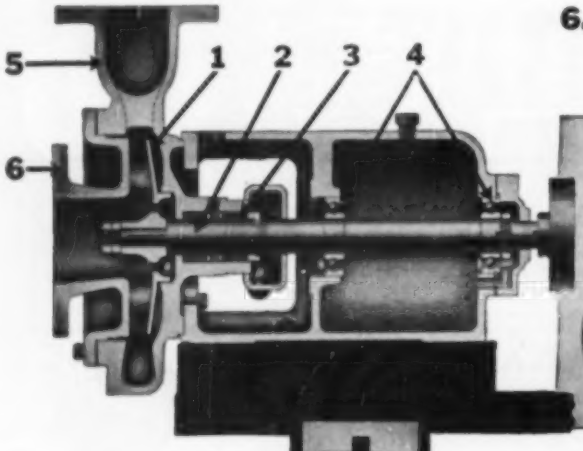
**❷ They are ARMORED AGAINST CORROSION — with *IRCAMET***

Ingersoll-Rand chemical pumps are built to stand up under the continuous handling of corrosive and abrasive liquids. All parts of the pump that come in contact with the liquid are made of IRCAMET — a high nickel-chromium-molybdenum alloy steel developed exclusively by I-R for chemical pump service. Laboratory tests and years of field experience have proved its exceptional ability to resist the corrosive action of a wide variety of acids and alkalis. Other materials are available for special operating conditions.

**❸ They are PROTECTED AGAINST LEAKAGE — with the *LEAKOLLECTOR***

The patented LEAKOLLECTOR stuffing-box gland — an exclusive feature of all I-R chemical pumps — provides a simple and effective solution to the problem of pump leakage. It completely encircles the stuffing box, trapping all leakage so that it can be drained away for collection or disposal. The split gland is accurately fitted to both the inside and outside of the box, and will catch any seepage escaping between the shaft and packing, or between the packing and the bore of the box. The LEAKOLLECTOR is easily removed from the shaft for repacking the box.

1. The impeller is of simple, one-piece construction, provided with balancing ports so that the stuffing box is under suction pressure.
2. The short, rigid, stainless-steel shaft prevents impeller whip and eliminates many stuffing-box problems.
3. The deep stuffing box holds 5 to 7 packing rings and a seal cage, and can be packed solid or arranged for internal or external seal. The packing is always especially selected for the liquid to be handled.
4. Two heavy-duty ball bearings provide rigid support for the rotor. The bearings are oil-lubricated and the oil is automatically maintained at the proper level.
5. The discharge nozzle is an integral part of the casing, and its vertical position makes the pump self-venting.
6. The suction nozzle is removable, permitting easy access to the impeller without disturbing the discharge piping.



The CAMERON SHAFT SEAL can be installed on all I-R chemical pumps to replace the conventional stuffing-box packing. It eliminates stuffing-box leakage and requires practically no attention or maintenance.

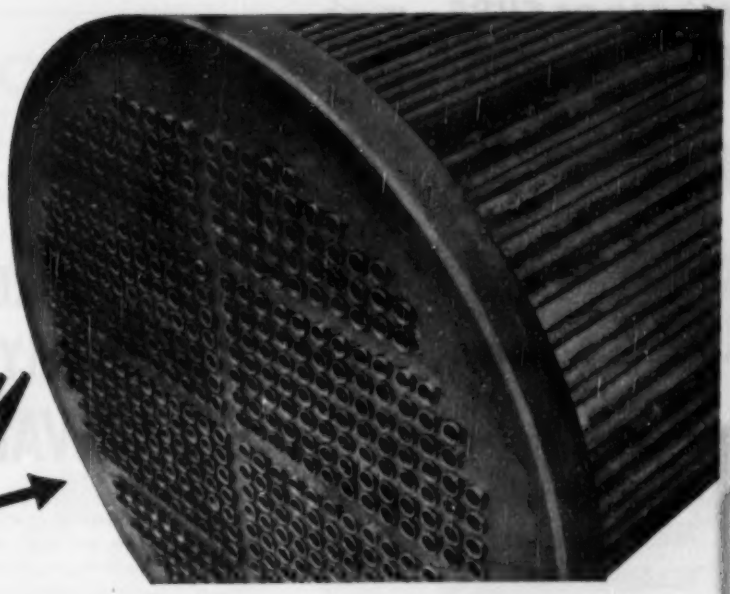
*I-R Chemical Pumps are of the centrifugal type, of simple cradle-mounted design, coupled to the driving motor. They are available in sizes to handle up to 4000 gpm at temperatures to 800° F.*

**Ingersoll-Rand**

CAMERON PUMP DIVISION
11 BROADWAY, NEW YORK 4, N. Y.

364-10

*For economy here →*



# MONEL-CLAD STEEL TUBE SHEETS CAN BE RE-USED

The Monel® cladding guards against corrosion.

The steel base permits *re-rolling*...no need to scrap Monel-Clad tube sheets when re-tubing.

You get *solid metal* advantages with clad steel economy.

Where circulated liquid is brine or otherwise corrosive, Monel-Clad tube sheets can be expected to give exceptional service... even when other metals have proved unsatisfactory.

Because of its high corrosion-resistance and its long life economy, Monel-Clad Steel has found wide acceptance in the petroleum and chemical industries where adverse conditions are a threat to operating equipment.

Lukens Monel-Clad Steel for tube sheets meets the standards of the Tubular Exchanger Manufacturers Association. A uniform, ⅜ in. thickness of Monel is permanently bonded to ASTM A-212 Grade B backing. Cladding of this thickness will accommodate the pass partition grooves and first hole tube groove.

For your convenience, Lukens Monel-Clad Steel for tube sheets is stocked in ready-to-use standard plates. Thicknesses now available range from 2 in. to 4 in., in ½ in. increments.

For further information and prices on Lukens Monel-Clad Steel, write directly to the Lukens Steel Company, 524 Lukens Building, Coatesville, Penn.

And for the tough jobs, Monel condenser tubing is available from stock in ¾" diameter and wall thicknesses of 14 and 16 gauge. For sources of supply, write directly to Inco.

**THE INTERNATIONAL NICKEL COMPANY, INC.**

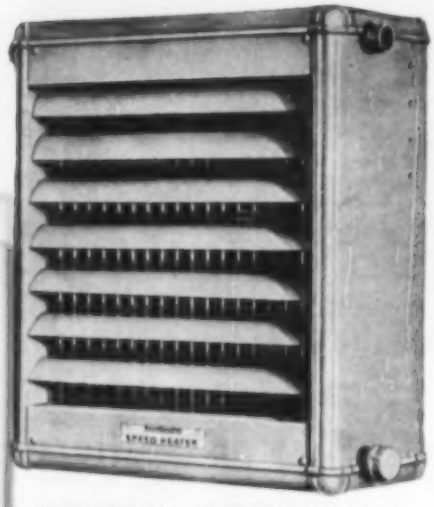
*67 Wall Street, New York 5, N. Y.*

**MONEL... for minimum maintenance**

EMBLEM OF SERVICE INCO

YOU CAN BE SURE...IF IT'S

# Westinghouse



## FOR FEATURES THAT REALLY COUNT! STURTEVANT HEATERS

These heaters combine the experience of two great leaders—Westinghouse in electricity and Sturtevant in heating and ventilating. You are assured of undivided responsibility, superior performance, a wide range of capacities to choose from—in short, the most efficient heater to fit your particular needs. Get in touch with your nearest Sturtevant office, or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

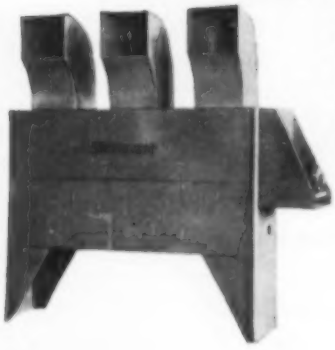
### HORIZONTAL SPEEDHEATER®

1. Fast Heat Delivery—by efficient, quiet-operating fan.
2. Simplified Installation—inlet and outlet connections on either side.
3. Easily-formed Handy Hangers—at no extra cost.
4. Dependable Westinghouse Motor—backed by nationwide Motor Service Plan.
5. Low Maintenance Cost—single row radiator assures uniform tube expansion, freedom from radiator distortion, longer life. Tested for 200 lbs. steam pressure.
6. Capacities—from 25,000 to 300,000 Btuh.

### DOWNBLAST SPEEDHEATERS

1. Excellent Heat Distribution for High-Ceiling Applications.
2. Connections on Both Sides Save Piping Costs.
3. Greatly Reduced Ceiling Heat Loss, Lower Fuel Costs.
4. Capacities—from 40,000 to 450,000 Btuh.

### MULTIVANE HEATER



1. Large volumes of Heated Air, Evenly Distributed.
2. Installed on Floor, Wall or Ceiling.
3. Rugged, Simple Construction; Working Parts Easily Accessible.
4. Capacities—44,100 to 1,177,000 Btuh.

Westinghouse
Sturtevant Division

# Combining a centrifugal with a mixing tank did away with trouble-making time lag

ANOTHER **A.T.&M.** SUCCESS STORY BY **Sam Spinner**

SAM, THIS COMPOUND IS A PROBLEM. THE SLIGHTEST TIME LAG BETWEEN MIXING AND CENTRIFUGING CAUSES IT TO SETTLE. RESULTS ARE BAD.
I BELIEVE I CAN SOLVE THAT, JOE...

MOTOR-DRIVEN AGITATOR PREVENTS MIXTURE SETTLING. MIXTURE ENTERS CENTRIFUGAL DIRECTLY THROUGH A VALVE—CONTROLLED SPOUT.

2 MONTHS LATER
RESULTS ARE PERFECT, SAM! NO MORE TROUBLE WITH THAT COMPOUND. THE NEW TANK ARRANGEMENT DOES AWAY WITH TIME LAG.
YOU CAN COUNT ON A.T.&M. TO PROCESS CHEMICAL JOBS FASTER, BETTER, AT LESS COST.

Let us bring you up to date on what modern centrifuging can do. JUST MAIL COUPON. NO OBLIGATION.

SAVE TIME, SPACE AND COSTS WITH

## A.T. *and* M. CENTRIFUGING

**AMERICAN TOOL & MACHINE COMPANY**
**1415 Hyde Park Ave., Boston 36, Mass.**

Please send information on centrifuging applied to the following processes:
☐ Extraction ☐ Filtration ☐ Dehydration ☐ Coating ☐ Precipitation
☐ Sedimentation ☐ Impregnation

Write here any other process .....

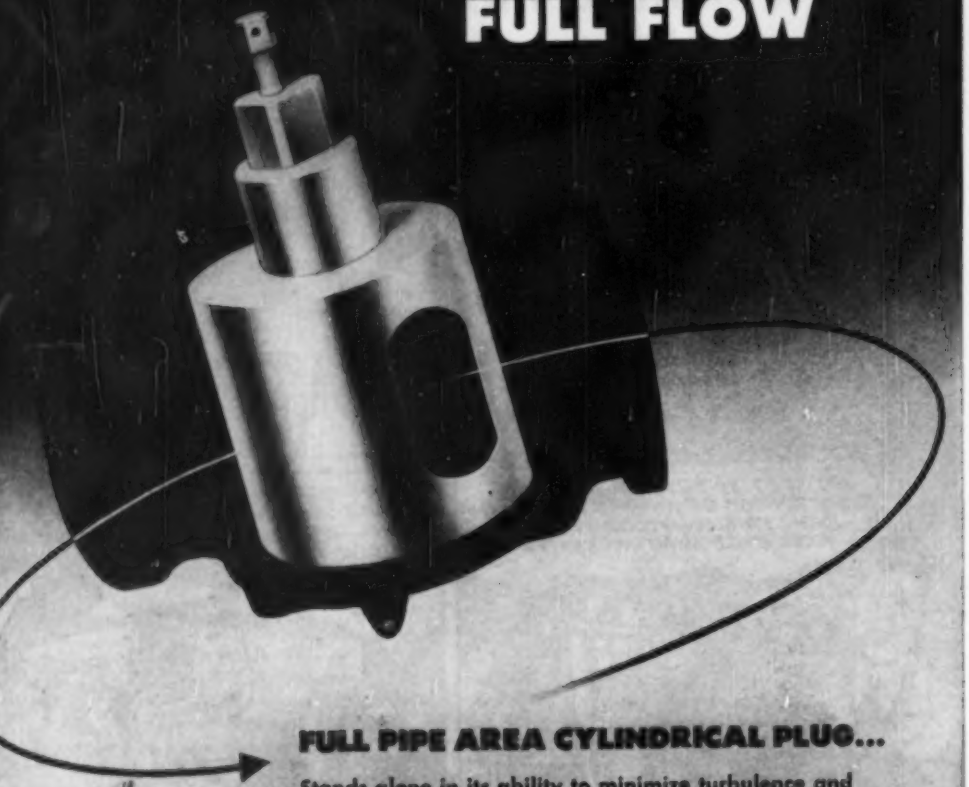
Name ..... Title .....

Company .....

Street .....

City ..... Zone ..... State .....

# UNINTERRUPTED FULL FLOW



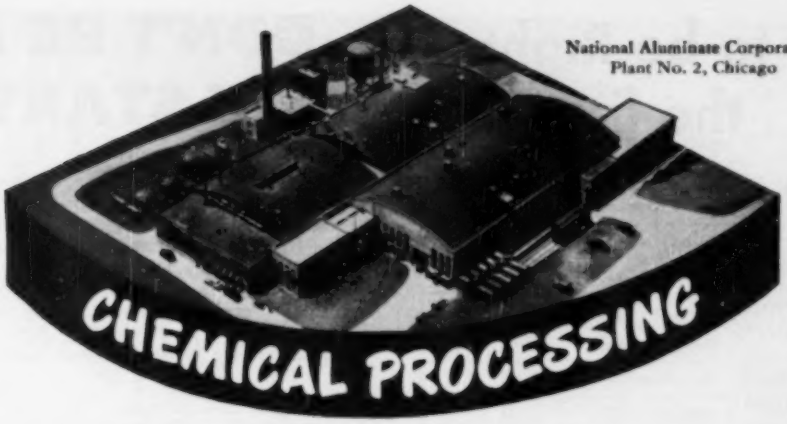
**FULL PIPE AREA CYLINDRICAL PLUG...**

Stands alone in its ability to minimize turbulence and change of velocity, without use of larger-than-pipe-size valves. Quick operation, if needed, no wedging, lubricated for long life and corrosion protection...why anything but an A.C.F. Lubricated Plug Valve.

a.c.f. CYLINDRICAL FULL PIPE AREA LUBRICATED PLUG VALVES

Representatives in more than 50 Principal Cities.

A.C.F. Valves are available in many types and sizes. Ask for catalog CM-4. American Car and Foundry Company, 30 Church St., New York 8, N. Y




National Aluminate Corporation
Plant No. 2, Chicago

# Multi-Stage Continuous Drying Systems at NATIONAL ALUMINATE CORPORATION

## *Emphasize The Versatility of GAS*

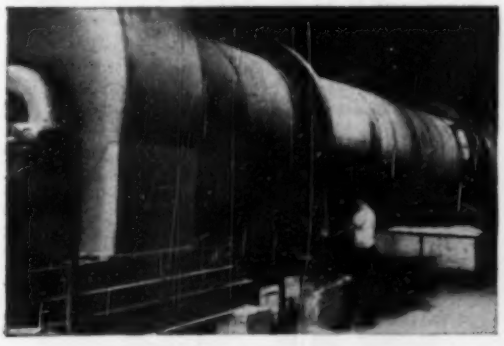
DESICCATING SYSTEMS, integrated with the chemical processes help National Aluminate Corporation meet the increasing demand for its synthetic zeolite water softening compound.

Three continuous multi-zone ovens, heated by GAS, are automatically controlled to provide the exact zone temperature for every stage of the operation. This automatic controllability of GAS permits regulation of the oven temperatures for the type of product being dried.

In addition to the oven-drying system, National Aluminate Corporation depends on GAS for reducing the moisture content of a catalyst used in producing aviation gasoline. The catalyst passes through the continuous Gas-fired multi-stage ovens, and then is finally processed in a rotary drying kiln equipped with luminous flame GAS burners.

These two applications of GAS demonstrate the most efficient utilization of the fuel in continuous, high-speed drying. Flexible Gas Equipment offers many an opportunity for economical heat processing in chemical manufacturing. You'll find it's worth investigating.

**The moisture content of a chemical catalyst is reduced in this 65-foot kiln equipped with North American luminous flame GAS burners.**



**Zeolite is dried in these multi-zone Proctor & Schwartz continuous Gas ovens.**

**AMERICAN GAS ASSOCIATION**
**420 LEXINGTON AVENUE, NEW YORK 17, N. Y.**

# How to be Right the first time

## WHEN SELECTING STEAM TRAPS

No single type of trap is suitable for all applications. But one of the four distinct Sarco types will be exactly right for any given application. Some provide quicker warm ups in the morning, some extract more of the heat, some are better for fluctuating condensate loads and others are better for out of doors.

| APPLICATION | 1st CHOICE | 2nd CHOICE |
|---|---|---|
| Process Tanks, small | A | C |
| Process Tanks, large | B | C |
| Dryers, Coil Type | B | A |
| Dryers, Fan Type | B | C |
| Drying Tumblers | B | A |
| Water Heaters | B | C |
| Preheaters, Fuel Oil | B | C |
| Rotating Cylinders | B | B |
| Slashers | B | B |
| Dry Cans | B | B |
| Flat Work Ironers | C | B |
| Presses, Laundry | C | A |
| Stocking Forms | C | A |
| Presses, Plastics | C | A |
| Presses, Platen | C | A |
| Evaporators | B | C |
| Steam Lines Outdoors, small | A | D |

*Ask for Technical Bulletin No. 2

**A THERMOSTATIC**

Wide open when cold for quick starts. Retains more of the heat before releasing condensate. Large valve orifice purges air quickly when starting. No seat changes when pressures change. Cannot freeze. Bulletin No. 250.

**B FLOAT**

Ball float allows continuous discharge without shock to temperature controls and other instruments. Automatic thermostatic by-pass takes care of air and gases without steam waste. All pressures up to 200 psi. Bulletin No. 450.

**C BUCKET**

Intermittent, but very rapid—can handle large volumes of condensate. Air goes out with the condensate. All parts attached to cover provide easy inspection. Straight-through connection makes installation easy. Integral strainer inside. Bulletin No. 350.

**D LIQUID EXPANSION**

A low cost combination of trapping and approximate temperature control. Ideal for outdoor tanks and lines and other points where condensate cannot be returned. In other forms, used as combination trap and control for wash tanks, food equipment, etc. Catalog Nos. 250 and 550.

267

**SARCO** SAVES STEAM

IMPROVES PRODUCT QUALITY AND OUTPUT

**SARCO COMPANY, INC.**

*Represented in Principal Cities*

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SARCO CANADA, LTD., TORONTO 5, ONTARIO

# DON'T BE A LATE STARTER

1950 promises to be a tough, competitive year. One way you can get a fast start on profitable operation is to use standard Wilson-Dudgeon Tube Expanders to help solve your production or maintenance problems on tubular apparatus. Backed by 97 years of solid experience, Wilson-Dudgeon Tube Expanders will assure you of fast, easy, reliable tube rolling to cut down-time and increase production-time. Here are two of the profit-making Wilson-Dudgeon Tube Expanders:

**Wilson-Dudgeon Model 38 Tube Expander for tubes 1" O.D., up. Self-feeding, parallel rolling and flaring action seats tubes quickly and solidly.**

**Wilson-Dudgeon Model 41 Tube Expander, parallel rolling, self-feeding with ball bearing thrust collar for rolling heat exchanger tubes ½" O.D. to 2½" O.D., into tube sheets to 6".**

No matter what your tube expander problem, you can be sure of getting a Wilson-Dudgeon Tube Expander that will fit your specific application. Write us, giving full details or send for Bulletin 380.

## CUT FUEL COSTS *with* WILSON TUBE CLEANERS

Remember—1/16" of scale often wastes 10%, or more, in fuel. A Wilson Tube Cleaner makes short work of the toughest deposits . . . cleans both ferrous and non-ferrous straight or curved tubes. Air, steam, water or electrically driven cleaners available for tubes 3/8" I.D., to the largest ever cleaned. Write for Bulletin 47-A.

THOMAS C. WILSON, INC., 21-11 44th AVENUE, LONG ISLAND CITY 1, N. Y.

TW-77A **WILSON** TUBE CLEANERS

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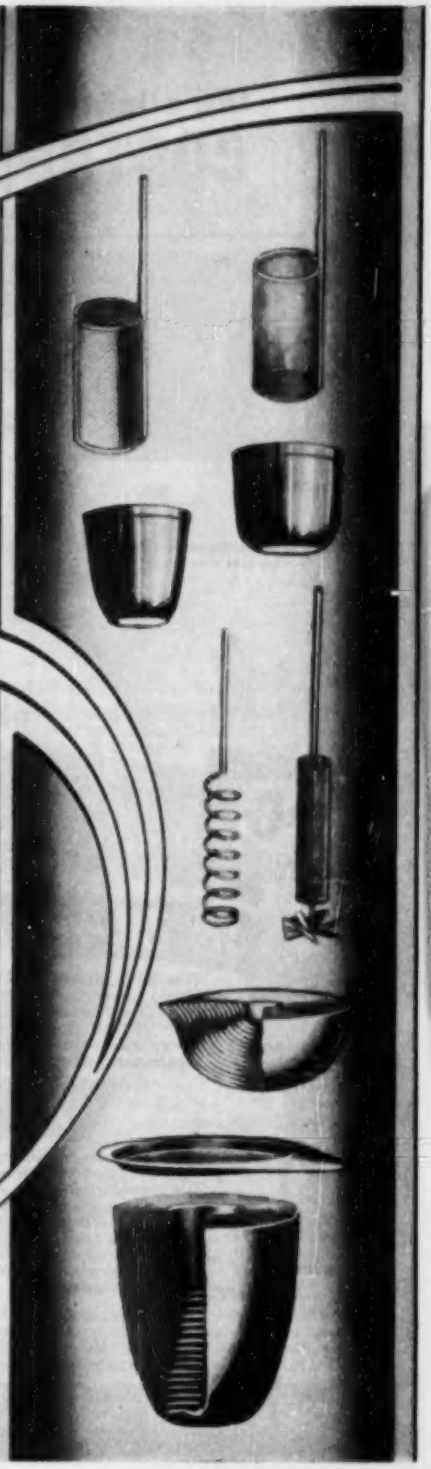
## *Tested by Use*

We have been manufacturing platinum laboratory ware for almost three quarters of a century and during that period have done much to bring this ware to its present exactness and high state of development. We introduced platinum-rhodium alloy laboratory ware, which is now so highly regarded, and such design changes as our reinforced rim crucibles and dishes and the Baker Low Form Crucible.

Because, naturally, our large scientific laboratories use apparatus manufactured by us in their own work, Baker Laboratory Ware is constantly subjected to continuous tests through use and so we are enabled to detect the need for improvements. An example was our observation of the tendency of stationary type electrodes to break at the junction of stem and cylinder, a fault which we overcame by reinforcing this joint.

Let us send you a copy of *Data Concerning Platinum*. It tells about our products and is a very valuable reference work too.



**BAKER & CO., INC.**

113 Astor St., Newark 5, N. J.

NEW YORK SAN FRANCISCO CHICAGO

## the slightest corrosion
# COSTS MORE

ATLAS HAS SERVED INDUSTRY FOR OVER FIFTY YEARS.

***than the NEW ATLAS coating that will prevent it!***

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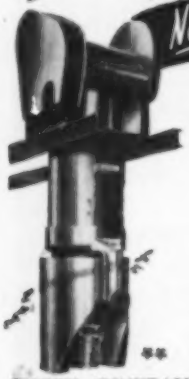
Zenith Continuous Pulp Presses Now Available in 3 Models

## New ZM Press



The ZM Continuous Pulp Press is the answer to the demand for a press of smaller capacity, but retaining the high efficiency and all of the outstanding features of the parent press.

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Zenith* Model ZL Pulp Presses are being used for dewatering, beet pulp, pineapple, tomato pomace, corn germ and fibre, vegetables, brewers grain, cherries, citrus fruits, fish, paper pulp, and many other materials, assuring a direct cake of uniform consistency.

100% continuous . . . from storage bin to pressed cake, the ZL Press dewaters *up to 26 tons of wet pulp per hour.*

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The job called for a light oil coolant. With its low flash point the oil frequently caught fire from heat generated by machining.

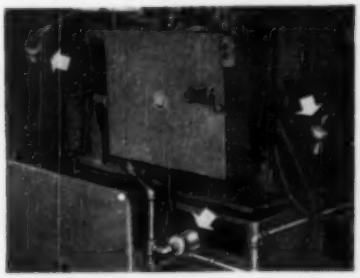
The extinguishers used by the company killed these repeated fires successfully. But the extinguisher chemical spoiled the coolant—left a mess on the machine. And downtime needed to clean the machine and replace oil after a fire was never less than 16 hours—often ran to 2 or 3 days.

Kidde extinguishing systems were installed on all these screw machines. They detect and kill fires automatically. The dry clean $CO_2$ discharged by the *Kidde* systems doesn't mess up the machine. It evaporates from the coolant oil, leaving no trace. After a fire, *downtime is 1 hour, no oil need be replaced.*

The *Kidde* systems cost $800 per machine. *The company says they paid for themselves in the first month!*

That's how our friends, the auto manufacturers, figure they got the *Kidde* installation free. You'd figure that way, too, wouldn't you?

If you want to know more about *how* such systems work, mail the coupon for literature.



Arrows show location of *Kidde* Multijet Nozzles through which $CO_2$ is discharged to kill fires starting on automatic screw machine during cutting operations. The $CO_2$ does the job fast—and clean.

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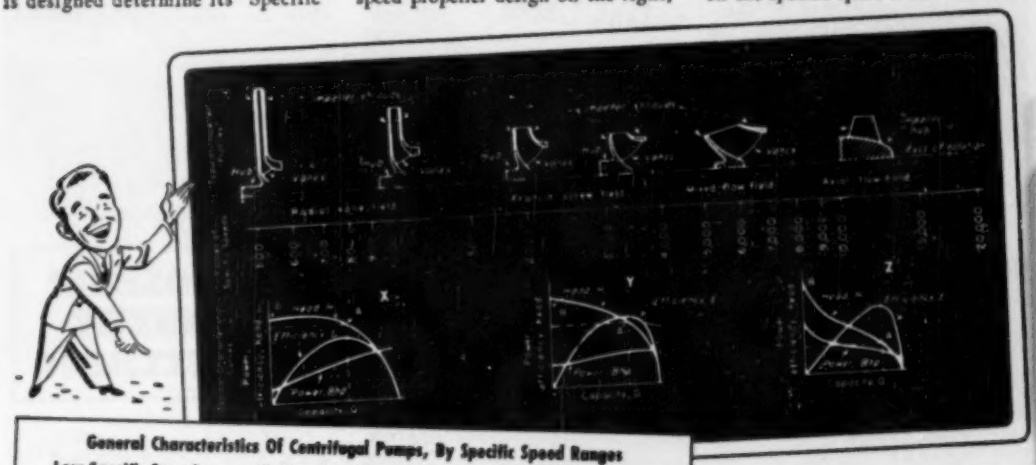
# Pointers on Pumps

## How Do Head, Capacity and Speed Affect Centrifugal Pump Design?

The head, capacity and speed for which a particular centrifugal pump is designed determine its "Specific Speed." Pumps having the same "Specific Speed" will have like proportions and characteristic curves.

The illustration shows several typical pump-impeller profiles, ranging from the low specific speed radial flow on the left to the high specific speed propeller design on the right, each design being placed in its proper position with relation to the specific speed scale. Below the scale, characteristic curves X, Y and Z indicate the hydraulic characteristics of three pumps, each designed for a specific speed corresponding to its position on the specific speed scale.




**General Characteristics Of Centrifugal Pumps, By Specific Speed Ranges**

| Low Specific Speed — Diagram X | Medium Specific Speed — Diagram Y | High Specific Speed — Diagram Z |
|---|---|---|
| Small rise in head from point of maximum efficiency "A" to shut-off "B". | Steeper rise in head from "A" to "B". | Very steep rise in head from "A" to "B". |
| Wide capacity range at high efficiency. | Moderate capacity range at high efficiency. | Narrow capacity range at high efficiency. |
| Rapid decrease in bhp from point of efficiency "A" to shut-off "B". | Nearly constant bhp from "A" to "B". | Rapid increase in bhp from "A" to "B". |

These basic characteristics may be modified to obtain certain desirable features. For example, although boiler feed pumps have low specific speed, they require a steadily rising head-capacity curve — not one that droops toward shut-off, as shown. There can be any number of pump designs in-between and beyond the few typical ones illustrated here.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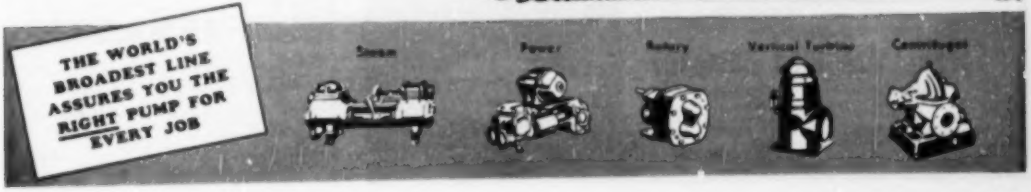

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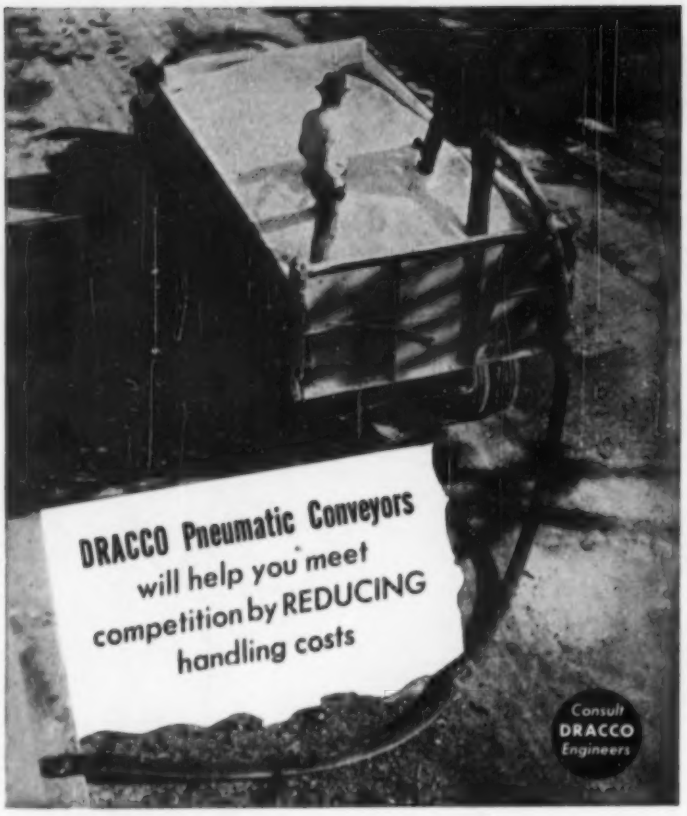


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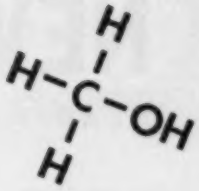


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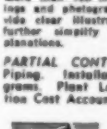


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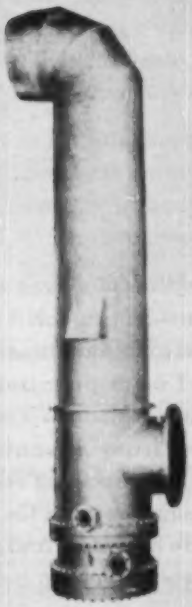

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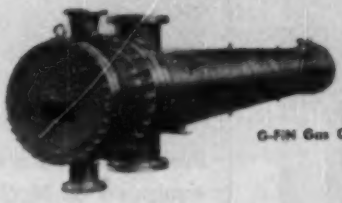

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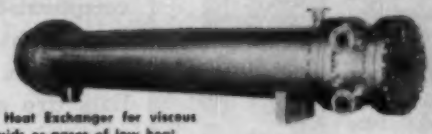

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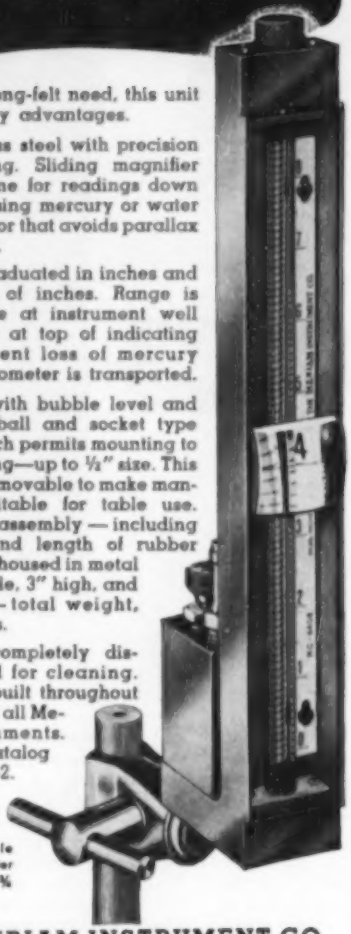

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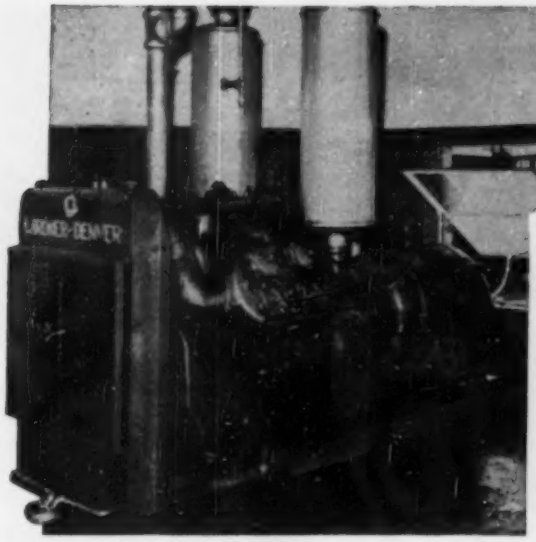


## "6,552 WORKING HOURS— AND WE HAVEN'T TOUCHED IT YET!"

*"Our WB Compressor has now been in operation for a total of 6,552 working hours. A wrench has never touched the machine, and not one single cent has been spent for repairs. We plan to have the valves cleaned soon, but outside of that, the machine is in perfect running order."*

*—excerpt from owner's letter.*

Low maintenance is just *one* of many major advantages in a Gardner-Denver WB Vertical, Two-Stage, Water-Cooled Compressor. You get big capacity, high efficiency air supply in limited space. A self-contained cooling system effectively lowers the discharge temperature—permits operation where good cooling water is scarce. And the WB is a packaged unit, easily installed and ready to go to work.

Gardner-Denver WB Compressors are built in capacities from 142 to 686 cubic feet displacement per minute. Write today for full details.

*SINCE 1859*

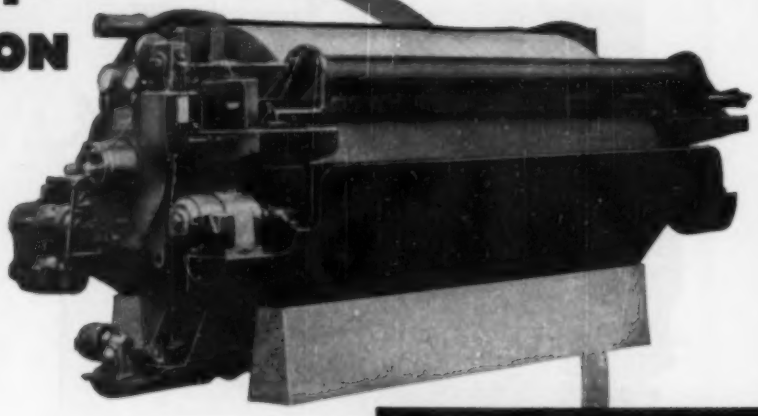
**GARDNER-DENVER**

Gardner-Denver Company, Quincy, Illinois

*In Canada:*
Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

# OLIVER "PRECOAT" FILTRATION

Often the Best for "Hard-to-Filter" Solutions



*Solutions with Sticky Solids

*Solutions with Small Amounts of Solids

*Solutions requiring High Polish

We're talking now about continuous vacuum filtration in contrast to batch pressure filtration which, until recently, had to be used on all such solutions. Today, the story is different. Today, by means of the Oliver Precoat Filter, continuous vacuum filtration can be used on most "difficult-to-filter" solutions... and to great advantage.

If you are handling such solutions on batch pressure filters with their attendant heavy manual handling and general messiness, investigate the Oliver Precoat Filter and its possibilities for helping to reduce your filtering costs.

The way the Precoat Filter works is briefly this: first a thick cake of a pervious filter medium or precoat is built up on the drum (taking an hour or two); then the solution to be filtered is fed into the tank or vat while keeping the drum rotating and the vacuum on. The thin film of solids forming on the surface is shaved off continuously, always leaving a fresh surface of precoat for further cake deposition. In this way the cake never gets thick enough to retard or stop the flow of filtrate. That's why the Oliver Precoat can handle those "difficult-to-filter" solutions. Actual filtering cycles last from several days to several weeks continuous operation, depending upon how much precoat has to be removed each revolution.

## OLIVER UNITED FILTERS INC.

New York 18, N. Y.
33 West 42nd Street

San Francisco 11, California

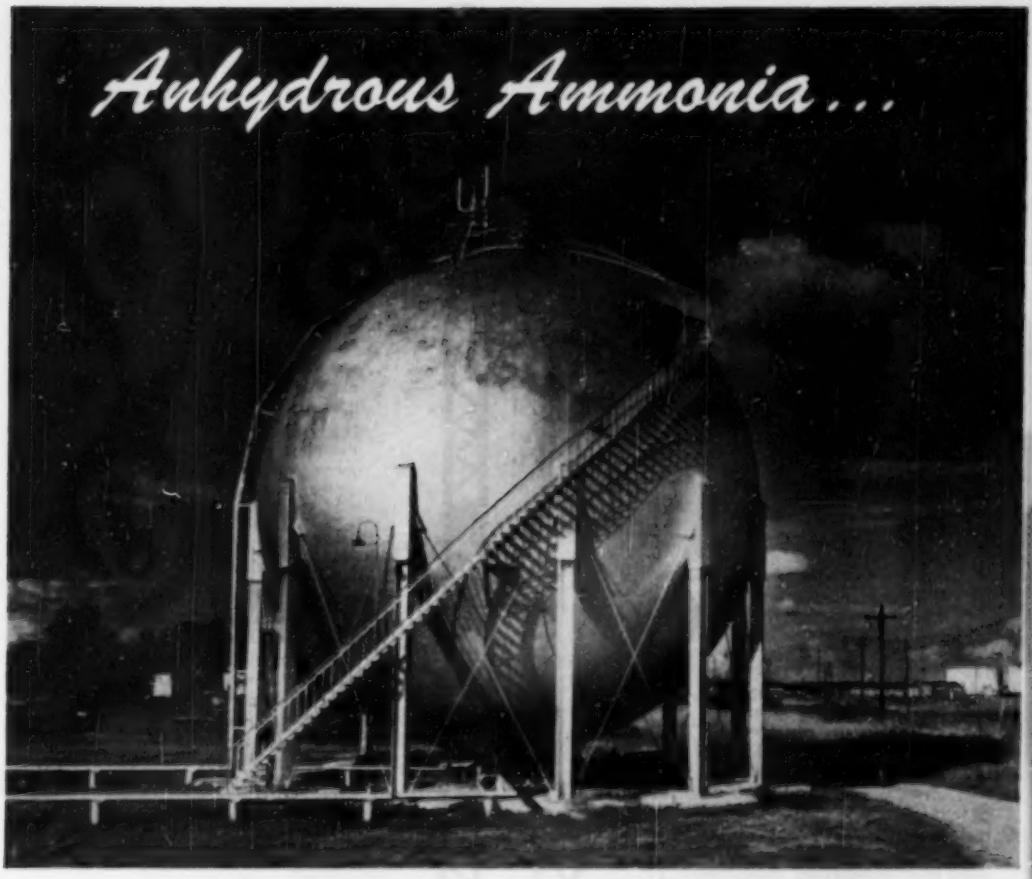
Chicago 1, Ill.
221 N. LaSalle Street

Western Sales Division
Oakland 1, California
2900 Glascock Street

Sales and Manufacturing Representative:
E. Long Limited
Orillia, Canada

Factories: Oakland, Calif. • Hazleton, Pa. • Orillia, Canada • Melbourne, Australia

# *Anhydrous Ammonia...*



## New Fertilizer stored in HORTONSPHERES

*Anhydrous ammonia*—ask an agricultural expert about applying this amazing new fertilizer and he'll mention "Nitrogation*" or "Nitrojection*". Ask an ammonia producer about storing this volatile chemical and you'll probably hear "in a Hortonsphere, of course".

Both are emphasizing an important point—it takes pressure to properly handle and store this product. For instance, in the Nitrogation method of fertilizing, the ammonia is discharged from pressure tanks into irrigation water. Because ammonia combines readily with water, it is easily absorbed by the soil. Nitrojection means crop fertilization by $NH_3$ injected directly into the soil from a tractor-mounted pressure tank.

Back at the plant, pressure is needed to keep most of the ammonia as a liquid during storage. That's one reason why the Hortonsphere is used so frequently. It's chosen for other reasons too. It's better for volume storage than a battery of horizontal units because it requires less ground space and needs only *one* set of pipe connections and fittings. It's easy and economical to maintain because all parts are readily accessible for inspection and painting.

When you're handling any volatile chemical, new product or old standby, use the Hortonsphere for effective, economical storage. Write our nearest office for Bulletin F for details on pressures and capacities.

*Above: 15,000-bbl. Hortonsphere storing anhydrous ammonia for the Dixie Liquid Fertilizer Company at Sterlington, Louisiana.*

** Trademark registered U. S. Patent Office, Shell Chemical Corp.*

## CHICAGO BRIDGE & IRON COMPANY

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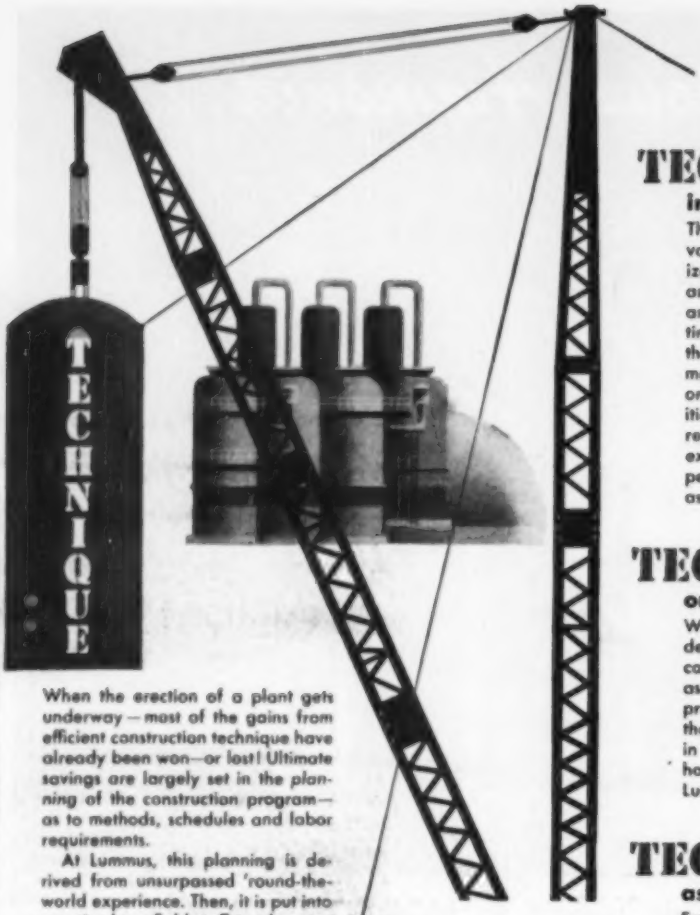
**Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA**




When the erection of a plant gets underway—most of the gains from efficient construction technique have already been won—or lost! Ultimate savings are largely set in the *planning* of the construction program—as to methods, schedules and labor requirements.

At Lummus, this planning is derived from unsurpassed 'round-the-world experience. Then, it is put into practice by a field staff to whom so-called "unpredictables" are old and familiar.

Sound technique, as Lummus applies it, means a sound night's sleep for those we serve who shoulder the responsibility.

# TECHNIQUE
## in planning

The full effect of detailed planning in advance of actual construction has been realized in foreign work where local facilities are at a minimum. It called for scheduled arrival of tools and materials, periodic estimates of manpower requirements and the preplanning of specific procedures for materials handling and heavy lifts. Economy in requirements for construction facilities, tools and equipment by preplanned re-use at various construction stages is one example. The selection of a staff with experience permitting effective reassignment as the job progresses is another.

# TECHNIQUE
## on the job

What makes it possible to move a 150-ton derrick intact from one tower-erection location to another, as contrasted to disassembly and reassembly? Planning—plus practical experience of the field staff on the job! Lummus field personnel has served in some 15 foreign fields, as well as at home, and averages better than 10 years' Lummus experience.

# TECHNIQUE
## as to costs

From an analysis of unit erection costs in which every man-hour is estimated in advance, Lummus lays the groundwork for continuing cost control. Periodic reports, detailing costs and work-progress, permit evaluation of all phases of the job from start to finish.

**THE LUMMUS COMPANY**
420 Lexington Avenue, New York 17, N. Y.

**LUMMUS**

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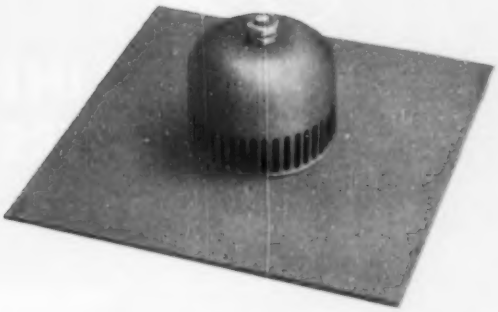
designs and builds with **TECHNIQUE**

teamwork
perspective
economy
fulfillment
resourcefulness

# "MANY TIMES LONGER LIFE FOR EQUIPMENT ON $H_2SO_4$ JOBS"

report users of *Carpenter*

## STAINLESS NO. 20 . . .



Fractionating tower parts can stay on the job longer *without replacement* when they are made from Carpenter Stainless No. 20.

Immersion heating unit with a sheath of Carpenter Stainless Tubing No. 20 stands up under almost continuous attack by *sulphuric, nitric, formic and other acids.*

In sulphonation or other processes which cause the formation of sulphuric, formic, acetic and other highly corrosive agents, Carpenter Stainless No. 20 is increasing equipment life from two to twenty times.

Similar in analysis to "Durimet 20" . . . Carpenter Stainless No. 20 is now available in:

- Tubing & Pipe
- Sheet & Plate
- Fittings
- Fastenings

*Bar stock, strip* and *wire* are produced by the Carpenter mill at Reading, Pa.

**14-Page Bulletin of Data on Carpenter Stainless No. 20**

To get this information on the corrosion resistance and working properties of Carpenter Stainless No. 20, send us a note on your company letterhead.

**THE CARPENTER STEEL CO.**
**Alloy Tube Division • 105 Springfield Road • Union, N. J.**

Export Department: 233 Broadway, New York 7, N.Y. "CARSTEELCO"

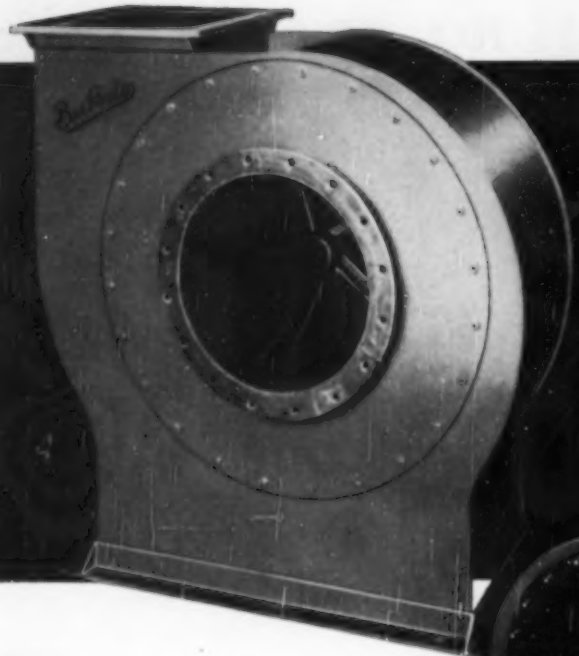
*Carpenter*

**STAINLESS NO. 20**

Licensed under patents of The Durion Co., Inc.

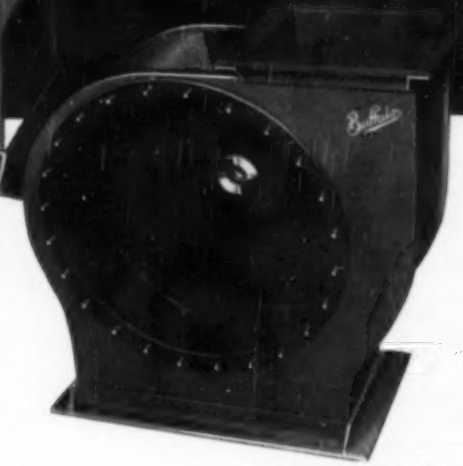
# The Money-Saving Answer

## TO YOUR CORROSIVE FUME PROBLEM



"Buffalo"

## RUBBER-LINED EXHAUSTERS



If you have corrosive fumes to remove, "Buffalo" Rubber-Lined Exhausters will give you 3 to 12 times longer service than metal fans. This "Buffalo" idea is not new —it has been saving the chemical industries money for many years. Rubber lining on all fan parts exposed to fumes protects the fan, where ordinary metal would be quickly destroyed. And high efficiencies in these "Buffalo" Fans add power savings to your maintenance savings. Put "Buffalo" Rubber-Lined Fans on your fume removal job, and you'll have the cheapest answer to this problem. WRITE FOR YOUR COPY of Bulletin 2424-E which gives all engineering data.

### FAN ENGINEERING

**Has The Answers To Your AIR PROBLEMS!**

Contains a wealth of engineering facts, in simple, concise form on

- fans
- heat
- humidity
- air
- drying
- air flow
- properties
- cooling
- sound laws
- heat transmission

**PRICE $6.00** **ORDER NOW**

## BUFFALO FORGE COMPANY

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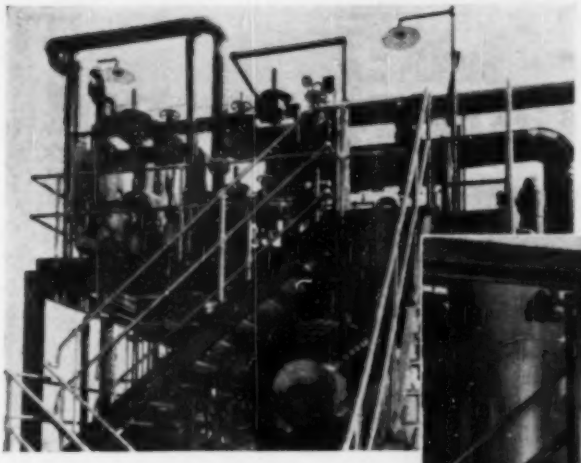
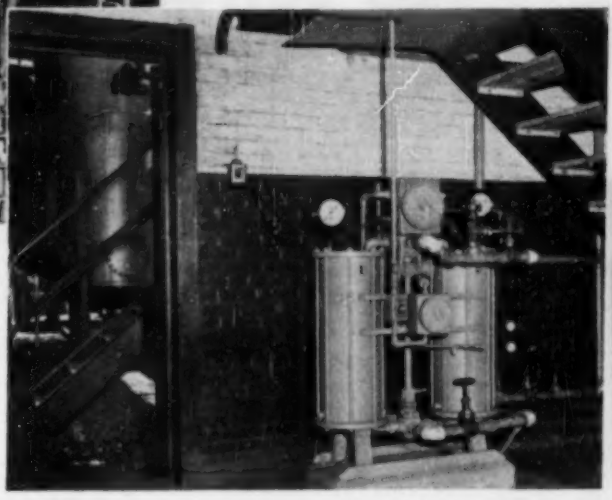
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

*Branch Offices in All Principal Cities*

"Buffalo" FIRST FOR FANS



Type BAC-50 Lectrodryer at the Bakelite Corporation, Bound Brook, N. J., and some of the outdoor valves it protects against unwanted moisture in the air lines.



## This Lectrodryer prevents freeze-ups at BAKELITE's formaldehyde plant

No moisture gets into control and valve operating lines here to cause freeze-ups. This Lectrodryer removes the moisture from the compressed air as it comes from the high pressure lines and keeps it DRY.

Other chemical companies use Lectrodryers to DRY the air, gases and organic liquids employed in their processes. Thus, reactions are held on the straight and narrow path; output is increased, quality is upped and held high. Costs are consequently reduced.

Many areas where materials are handled or stored are supplied with DRY air from Lectrodryers. Deterioration is greatly slowed down or stopped. Work there is no longer hindered by stoppages in chutes and conveyors caused by moisture-laden materials.

Whatever your moisture problem, Lectrodryer can help solve it. Write for Bulletin 216. Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Penna.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In Australia: Birlec, Limited, 51 Parramatta Road, Glebe, Sidney.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

**LECTRODRYER**

REGISTERED TRADEMARK U. S. PAT. OFF.

# YOU CAN'T AFFORD TO IGNORE THIS OFFER *(REALLY)*

There's a well equipped laboratory, staffed with highly trained and skilled technicians ready to go to work for you tomorrow morning—at no cost to you and without one iota of obligation on your part.

The laboratory is maintained by Proctor & Schwartz, Inc., of Philadelphia, designers and manufacturers of industrial drying equipment. It is operated for the *mutual* benefit of industries with drying problems—and, of course, for Proctor & Schwartz. We'd be utterly foolish to even intimate otherwise.

Into this laboratory every day, come widely divergent drying problems from many different industries and all parts of the world. Proctor engineers, utilizing all of the resources at their command, try to solve these problems. Some can be solved with a few hours of test work. Others take months of study and some remain unsolved or prove impractical. The manufacturer who places his drying problem in Proctor engineers' hands, has taken the first step in the right direction, for these men are trained in the art of drying, they have at their fingertips important data and findings of drying studies made during the last half century. For all of this, the prospective customer does not pay one penny. Of course, as each new problem comes in, it is our hope that the solution will indicate a place for the application of Proctor drying equipment. You can't blame us for that. However, often the results of much comprehensive study will reveal some other drying process to be the answer—rather than the atmospheric type of equipment manufactured by Proctor & Schwartz.

In that case, the results of the research are discussed with the client—They say, "thank you", we say, "you're welcome, sorry that your product isn't suited to our particular type of equipment". No money exchanges hands—for remember, we said, "no cost or obligation".

If the study indicates Proctor equipment to be suitable—the findings of the research are passed on to the preliminary engineering department and recommendations for a dryer design are made.

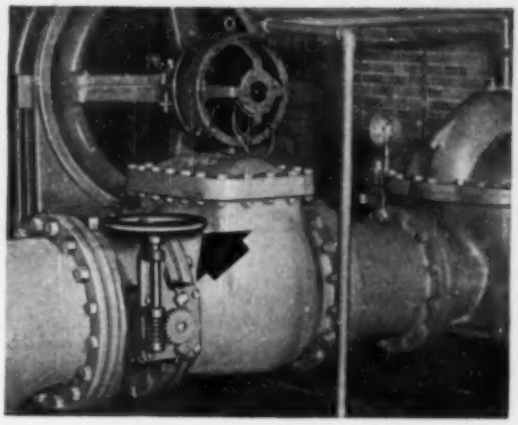
Regardless of the outcome of the research, YOU STAND TO BENEFIT. If it indicates Proctor equipment is not the answer—you've had $100 or $1,000 worth of research conducted for you absolutely free. If it finds Proctor equipment suited to your needs—you have the assurance that your drying equipment recommended, will be engineered on FACTS to suit your individual needs . . . and you'll still pay nothing for the research and test work.

See what we mean—you can't afford to ignore this offer. If you have a drying problem, don't waste time, manpower and money trying to solve it. Turn it over to Proctor engineers. IT WILL NOT COST YOU ONE RED CENT TO ENLIST THEIR AID AND SKILL. Write today . . . or call MIchigan 4-6400. If you are not considering a drying problem at the moment—tear out this page so that you will not forget it when a problem comes along.

**PROCTOR & SCHWARTZ, INC.**
**711 TABOR ROAD**
**PHILA. 20, PA. MIchigan 4-6400**

R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



# 6 HANDWHEEL TURNS OPEN OR CLOSE VALVE

This quick closing feature is an important consideration in water pumping operations as illustrated above or any application where a battery of synchronous driven pumps discharges into a common header.

Normal procedure when starting a pump is to shut off the discharge valve until the pump has gained the desired speed. The valve is then opened gradually. Since it requires only a few seconds of an operator's time, this important operation is not likely to be neglected when R-S Valves are installed. Burned-out motors at start-ups can be practically eliminated.

R-S Valves show substantial savings in pumping power due to low pressure drop. Consider also the compact design, light weight and self-cleaning features.

Consult with your local R-S representative. Look for the address and phone number listed under "R-S Products, Valves" or write direct.

**R-S PRODUCTS CORPORATION**
**Wayne Junction • Philadelphia 44, Pa.**

Sectional view shows beveled vane of R-S Valve firmly seated at a 12½° angle. A metal-to-metal seat gives satisfactory commercial shut-off in many cases. Manual or automatic control available.

Drip tight or bubble tight closure can be obtained with a rubber seat. Under pressure, due to the 12½° angle of closure, the rubber yields both radially and longitudinally around the shaft-bosses and the periphery of the valve vane to insure positive shut-off.

No. 709 30-inch 50-pound valve equipped with rubber seat. Air bubble tight at 80 psig and drip tight with water at 100 psig. Fully enclosed gear reduction drive. Every R-S Valve is available in smaller and larger sizes, in all materials and for lower and higher pressures.

*New!*

Catalog No. 18 featuring R-S 50-pound valves is just off the press. Ask for it!

# Which Centrifuge do I need?

There are differences in the application of centrifugal energy making one centrifuge the best answer to your particular separating or clarifying problem.

Each centrifuge below has a specific function which makes it preferred over others under certain conditions.

The Sharples Corporation alone manufactures *the complete line.* Therefore, after analyzing your problem, a Sharples engineer can make a truly unbiased recommendation. He is always at your call.

## SUPER-CENTRIFUGE

A tubular bowl centrifuge which develops the highest centrifugal force commercially available. Can separate immiscible liquids with extremely small differences in specific gravity.

## D-2-CENTRIFUGE

A disc-type centrifuge employing the stratification principle of high separating efficiency combined with high through-put capacity.

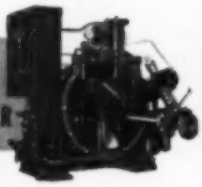
## NOZLJECTOR

A high efficiency disc-type centrifuge that continuously discharges solids as well as performing the clarifying or separating function.

## AUTOJECTOR

This disc-type clarifying or separating centrifuge intermittently and automatically discharges solids when a pre-determined "cake" has been built up.

## SUPER-D-HYDRATOR



Used for the recovery of crystalline solids from liquids, this high capacity centrifuge can efficiently handle slurries with 15 to 60% solids.

## SUPER-D-CANTER

A high capacity centrifuge used for the recovery of solids from liquids, the clarification of liquids or the classification of solids. Capable of handling a wide variety of solids.

The
SHARPLES CORPORATION
2300 WESTMORELAND ST. • PHILADELPHIA 40, PA.
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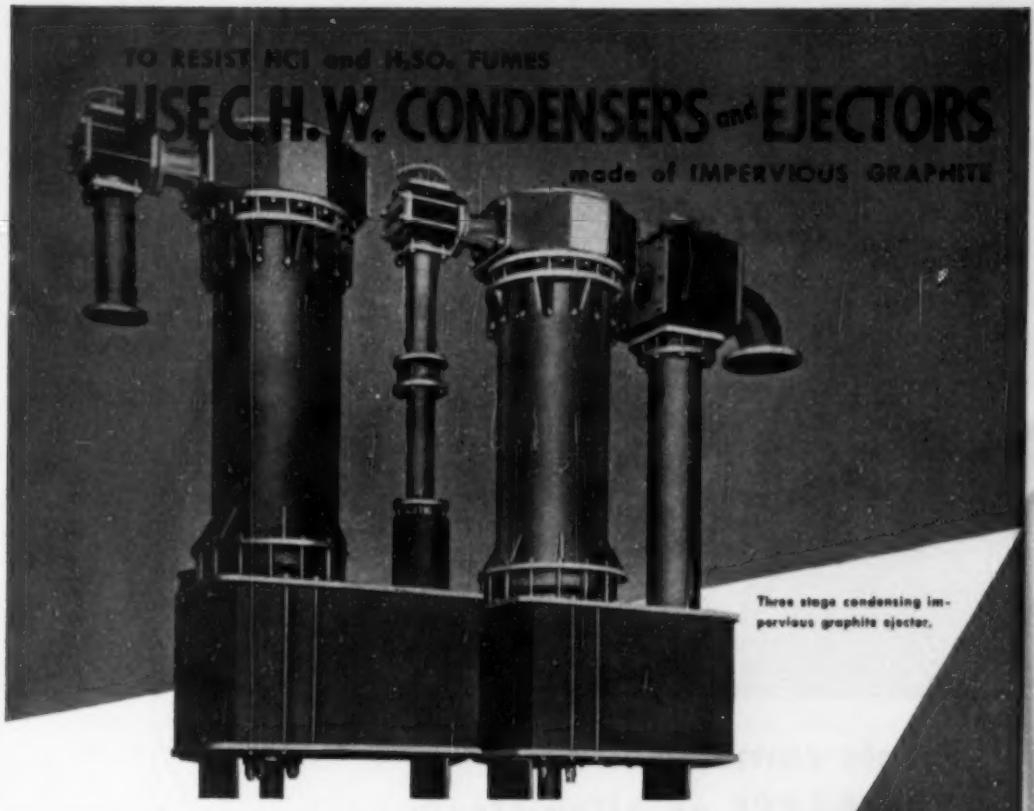
Sharples

TO RESIST HCl and $H_2SO_4$ FUMES

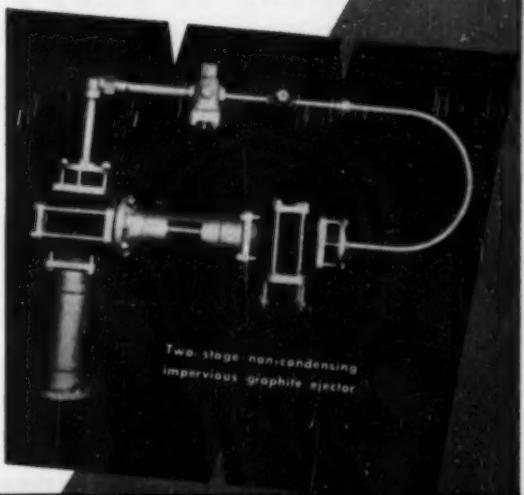
# USE C.H.W. CONDENSERS and EJECTORS

made of IMPERVIOUS GRAPHITE



Three stage condensing impervious graphite ejector.

Is your vacuum equipment taking a beating from corrosive hydrochloric and sulfuric acid fumes? If so, then you don't have to be reminded that it's a costly problem. But you would be interested in an economical solution, i.e., C. H. W. Tubejets and Condensers, cast in or lined with impervious graphite, effectively resist these corrosive acidic fumes. What's more, they are available in a wide range of standard sizes, which means money savings for you. By combining standard units—boosters, one to five stage steam jet ejectors, and barometric condensers—C. H. W. engineers can produce any vacuum easily. Single stage units will maintain pressures down to 3.5 inch mercury and multiple stages up to five will maintain absolute pressures below 250 microns. Tell us what difficulties you are having with corrosive fumes. It's more than likely that C. H. W. impervious graphite Tubejets and Condensers can eliminate your troubles, and at a small cost, too. Write now.

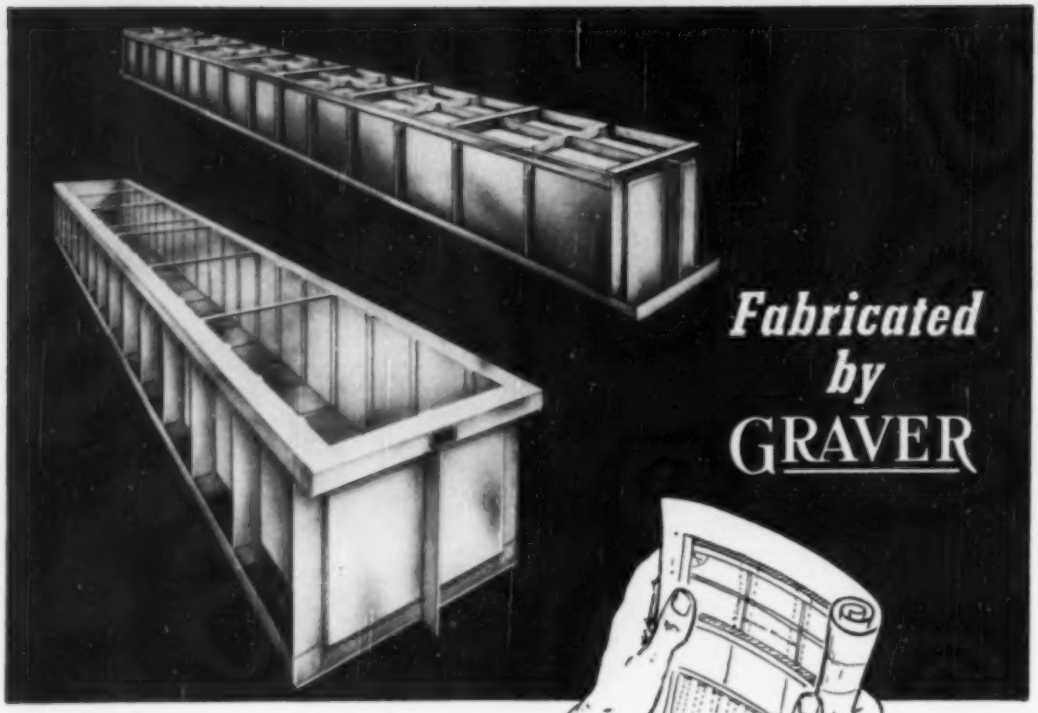


Two stage non-condensing impervious graphite ejector

**C. H. WHEELER MANUFACTURING CO.**
**1808 Sedgley Avenue, Philadelphia 32, Pa.**
REPRESENTATIVES IN MOST PRINCIPAL CITIES

*C. H. Wheeler*
SINCE 1883

STEAM CONDENSERS · WATER COOLING TOWERS
EJECTORS · STEAM JET VACUUM REFRIGERATION
OF PHILADELPHIA



*Fabricated by* GRAVER

## Prints come to life . . . *in STAINLESS or alloy steels*

This set of stainless steel "pickle" tubs fabricated for one of the world's largest brass companies is another example of the flexibility found in the versatile Graver "Hands of Skill".

Equipped and prepared by broad experience, Graver is ready to interpet your requirements in design prints which utilize stainless or alloy steels to the best advantage. Or if you prefer, Graver will work directly to your own drawings, economically translating them into the finished product. Graver has facilities and materials for work in stainless steel, stainless clad, nickel, nickel clad, Monel, Everdur, aluminum . . . in No. 12 gauge or heavier . . . and in finishes up to and including No. 4.

For money-saving reasons, for experience, for skill . . . let Graver take the responsibility for all phases of engineering, material procurement and shop or field work . . . *let Graver bring your prints to life.* Write today for recommendations and quotations.

**GRAVER—where THE tradition is SKILL**

**VESSELS LINED**
**IN STAINLESS OR ALLOYS**

*Graver is specially equipped to line existing vessels and towers in the field—using stainless steel or alloys.*

**STAINLESS AND ALLOY STEELS DIVISION**

GRAVER

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

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# You can't beat these drums!

Your product may be one of the thousands of items for which a fibre drum is just about the perfect package. And there are some thumping good reasons why a Continental fibre drum is the best drum you can use.

**Continental fibre drums can't be beat for rugged durability.** They give extra protection to both expensive and dangerous articles for shipment either in this country or abroad. The closures are tight and strong —but easy to open and close.

**Continental fibre drums can't be beat for shipping economy.** Their light tare weight means savings at today's high freight rates—even greater savings on export shipments to countries where import duties are levied on the gross weight.

**Continental fibre drums can't be beat for appearance.** They are neat and trim, tailored to your product, and feature quality printing or spray painting. Each Continental drum is a style leader in its field.

**Most important, Continental can't be beat for service.** There are four strategically located Continental fibre drum plants ready to give you fast, economical and dependable service. Continental packaging engineers are always ready to give you sound advice on packaging problems. Backing up these engineers is a modern laboratory staffed with qualified research and development people.

Continental is big enough and flexible enough to handle any situation. Again and again Continental customers say, "You make us feel as though your fibre drum department is part of our own company." We'd appreciate an opportunity to show you how much real help and service we can deliver.

## These drums can help you boom sales

1. The famous Continental LEVERPAK drum with its unique lever-locking device gives maximum protection under hard usage. 12- to 75-gallon sizes.
2. Continental FIBERPAK drum . . . a rigid, all-fibre container in ¼- to 67-gallon sizes.
3. Continental STAPAK drum. Has fibre body with metal top and bottom. Supplied in 2- to 32-gallon sizes.
4. Continental UPAK drum. Custom-made for the shipment of rolled materials.

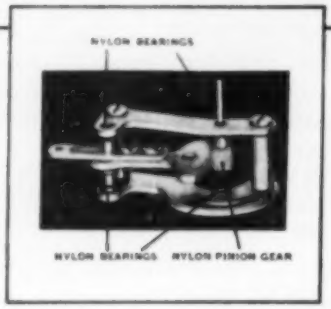
CONTINENTAL CAN COMPANY

# *Every Engineer should read this!*

THE TREND in gauge movement design over the years has been in the direction of increased bearing diameters and lengths, width of tooth engagement, hardness of wearing surfaces, and mass of parts in order to achieve *greater wear resistance.*

But in increasing the mass of parts, accuracy and sensitivity are invariably impaired and wear resistance is not necessarily improved. The high impact effect at bearing and other wearing points, which is related to the natural weight of the metal used, *creates wear!* The "products of wear" increase the rate of wear and when carbon particles are exposed, they rust.

The ideal conception of a gauge movement should, therefore, incorporate lightness in parts which move to enhance sensitivity and accuracy of indication and to lessen impact effects on severe service. The "products of wear" should not cause increased wear or be susceptible to atmospheric corrosion. The materials used at bearing and other wearing points should absorb or soften impact. Adequate strength and general corrosive resistance must be provided.




The Ashcroft Duragauge Nylon-Aluminum Movement* is a break with tradition, a completely new and revolutionary approach to movement design. It meets fully all these requirements!

The nylon parts provide impact absorption, retention of accurate form shape under sufficiently high temperature, no objectionable wear products (should any form), low friction and adequate corrosion resistance.

Aluminum contributes lightness in the mating parts which reduces potential impact to its lowest terms and increases sensitivity. The anodized surfaces enhance the low frictional properties of the aluminum. In contact, the aluminum tends to glaze the nylon which increases the wear resistance and lowers the coefficient of friction. The general corrosive resistance of aluminum is very good. And even in the case of such chemicals as methyl chloride and methyl bromide, which should not be used in direct contact with aluminum base alloys, the Nylon-Aluminum Movement in the Duragauge Vapor Proof case stood up well.

In laboratory and field tests on the worst pulsating services to be found, the Duragauge Nylon Movement outwore all other movements of whatever material or design.

In installations on "killing" services in refineries, chemical plants and power stations, the Nylon Movement showed its inherent superiorities.

We invite your inquiries concerning this new Ashcroft Duragauge movement.

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# *It's the Nash!*

Nash Compressors in your plant can automatically increase the capacity of your absorption equipment, for with the Nash it is possible to secure absorption directly in the pump.

This is due to the Nash liquid compressant operating principle, involving a fluid vortex through which the gas must pass in the process of compression. To absorb from a gas, simply flow absorbent through the compressor as the compressing medium. In this close contact of liquid and gas, the desired fractions are picked up and retained by the absorbent. This in no way impairs efficiency as a compressor.

This useful stunt is made possible by the fact that slugs of liquid entering a Nash Compressor do no harm to the pump structure. Nash pumps have only one internal moving part, simple, non-wearing, and employ no gas contaminating internal lubrication. There are no valves, gears, pistons, or sliding vanes, and original pump efficiency is maintained over a long life. In a single stage Nash Compressors produce 75 lbs. pressure or vacuums to 26 in. of mercury, with capacities up to 6 million cubic feet per day in a single structure. Investigate these pumps now.

**One moving part.**

**No internal wearing parts.**

**No valves, pistons, or sliding vanes.**

**No internal lubrication.**

**Low maintenance.**

**Slugs of liquid entering pump do no harm.**

**Original performance constant over a long pump life.**

**Non-pulsating pressure.**

**Saves floor space.**

**75 pounds in a single stage.**

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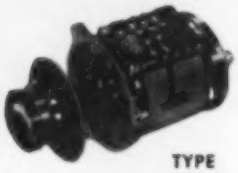

TYPE 116U

For back-of-panel mounting, incorporation in existing equipment.

TYPE 116-2

A ganged assembly for open-delta, three phase or series, single phase connection.

TYPE MT116

A motor-driven unit for push-button remote-control operation.

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POWERSTAT variable transformers Types 116 and 216 have been redesigned. It wasn't a mere "face-lifting" operation, although a streamlined appearance has resulted. It has incorporated many of your worthwhile suggestions and the latest technical knowledge of variable transformer design and manufacture. All improvements have been made within the old standard mounting dimensions to conform to your existing panel layouts, assuring easy replacement if desired.

### JUST A FEW OF THE IMPROVEMENTS

New fusing arrangement employed on cord-plug models. Twist-lock holder on side of terminal box gives easy access and simple replacement • New diecast aluminum terminal box on cord-plug models adds strength and longer service. On all models, the new, extra heavy and rugged terminal board of phenolic plastic prevents breakage. Solder-screw terminals arranged for better spacing for quicker, easier and more positive connections. Barriers between terminals reduce short-circuit hazards • Heavy-duty "ON-OFF" switch on cord-plug models is in a more convenient position to eliminate interference with input cord and output receptacle • Coil and core design provides excellent regulation, high efficiency and conservative rating for both 50 and 60 cycle duty • Polarity identification provided on cord-plug models for requirements involving ground loads.

Ratings of Types 116 and 216 remain the same. Type 116 operates from a 115V., 50/60 cycle, 1 phase source to deliver 0-135V., 7.5 amps. Type 216 has an output of 0-270V., 3.0 amps from 230V., 50/60 cycle, 1 phase. As in the past, the current rating is the current available over the entire range of output voltage. There's no need to refer to a graph to determine the allowable current at a specified value of output voltage.

Write today for complete details on these completely redesigned POWERSTAT Types 116 and 216.

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**with the New**

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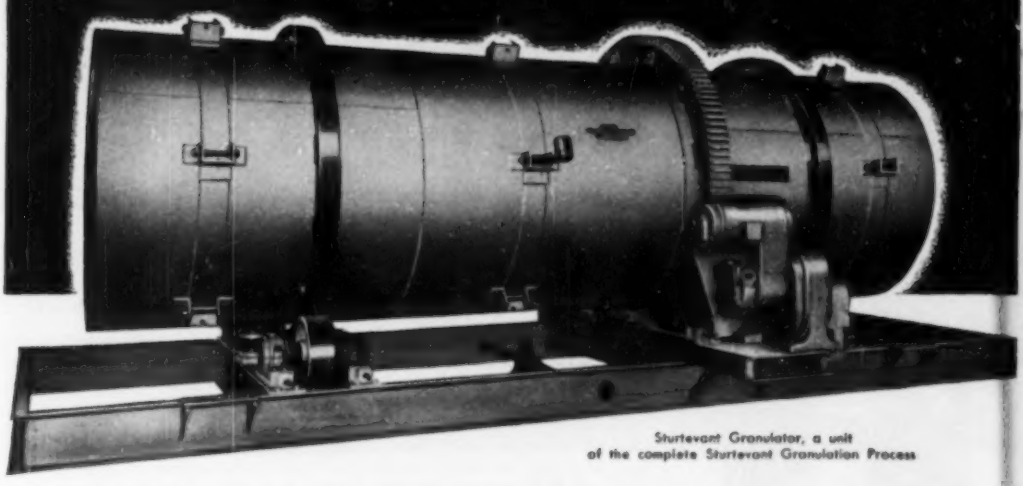

Sturtevant Granulator, a unit of the complete Sturtevant Granulation Process

★ ***Granular fertilizer can be stored over longer periods of time***

★ ***Holds chemical properties without deterioration***

It's here . . . the new Sturtevant Granulation Process for manufacturing granular or pelletized fertilizer. This outstanding method prepares fertilizer granules of uniform size. Its unique design and rugged construction assure long operating life with little if any maintenance.

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Advantages of granular fertilizer include . . . Granular fertilizer can be stored over long periods without caking, a typical fault of ordinary fertilizer. It means that this type of fertilizer can be bought at any time and used when necessary. Being in hard granular form, it holds its chemical properties without deterioration. In addition, evidence shows that granular fertilizer increases the fertility of the land because plant foods do not wash down below the roots as quickly. It reduces waste . . . saves on labor time of distribution . . . is especially effective for use when airplanes are used for distributing fertilizer.

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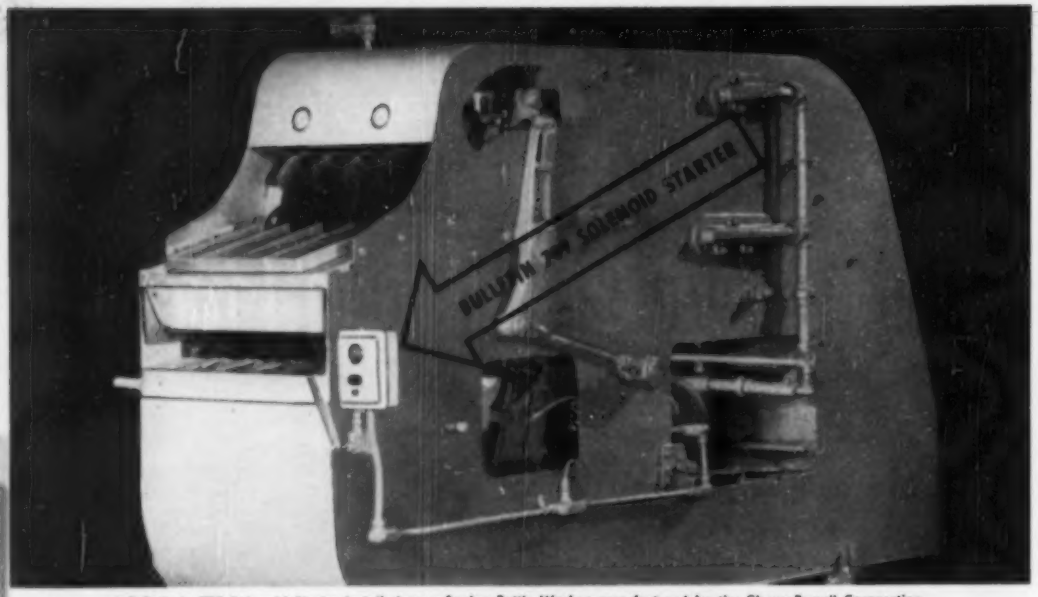


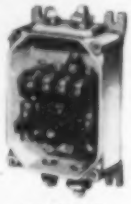

A-B Bulletin 709 Solenoid Starter installed on a Soaker Bottle Washer manufactured by the Cherry-Burrell Corporation.

*Trouble Free*

# SOLENOID STARTERS for DAIRY EQUIPMENT

**GENERAL PURPOSE**

Bulletin 709 Solenoid Starter in general purpose enclosure. Black enameled outside finish. Bright white interior makes wiring easy. Many knockouts.



**WATERTIGHT**

Bulletin 709 Solenoid Starter in watertight and weatherproof enclosure. A-B double break, silver alloy contacts need no maintenance.

Allen-Bradley starters are a must wherever reliable, trouble free starters are a prime requisite.

The Bulletin 709 Solenoid Starter provides overload protection and no voltage release. Only one moving part means years of maintenance free life. In wet, moist surroundings, Allen-Bradley starters in watertight enclosures give necessary protection to vital starter elements.

Allen-Bradley has a safe enclosure for every kind of job . . . wet, hazardous, dusty, corrosive. An A-B engineer will be glad to recommend the correct standard starter and enclosure for your motor control applications.

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**Allen-Bradley Automatic Starters are available in these enclosures**

**ALLEN-BRADLEY**
**SOLENOID MOTOR CONTROL**
QUALITY

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*AMMONIUM NITRATE TO ZINC SALT

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Take the case of the Allis-Chalmers straight-line, 2-pair high roller mill, illustrated above.

Here's a machine that's doing an *outstanding* job in chemical plants from coast to coast!

Note the heavy welded steel base . . . the streamlined aluminum housing with plexiglass window . . . and the smooth-running *Texrope* V-belt drive. Other features include: large 3-inch diameter roll journals, long-life Circle-Chill rolls, dependable roller chain differential.

Get the full story on this straight-line, 2-pair high roller mill from our nearby sales office or by sending coupon at right. Ask for bulletin 25B6057 — a handy A-C directory.

*Texrope* is an Allis-Chalmers trademark.

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A-2906

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MILWAUKEE, WIS.

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☐ Please have A-C representative make a personal visit with roller mill details.

☐ Please send A-C directory 25B6057.

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Company

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City State

# Eliminate Shutdowns

## FOR DUST FILTER CLEANING!

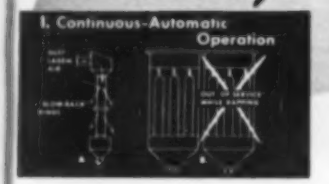
**DAY "Autoclean" DUST FILTER**

The **DAY** "Autoclean" Dust Filter was designed primarily for chemical and other industries requiring continuous-automatic filtering with constant air volumes. Because of its automatic cleaning mechanism, the **DAY** "Autoclean" never has to be shut down for cleaning or rapping. This maintains uniform back pressure assuring a constant air volume through the entire filter at all times. The result is a continuous, effective and efficient job on even the finest dust particles.

Actual installations are operating successfully with air to cloth ratios of 10, 15 or 20 to 1. In many industries the highly effective performance of the **DAY** "Autoclean" results in the saving of valuable product.

**Write For FREE Dust Filter Bulletin Number 491**

## Advantages OF THE DAY "Autoclean" DUST FILTER




**A.** Reverse air jet cleaning rings travel up and down the tubes of the **DAY** Filter constantly cleaning the cloth. This permits continuous filter operation with a maximum cloth area loss of only 1¼%.

**B.** Most other types of filters must shut off a complete section for cleaning or rapping. This may amount to 50% of the cloth area.

**A.** Back pressure rises slightly when the **DAY** Filter is first started, then levels off and remains uniform. This assures the constant air volume necessary for maximum dust collection efficiency.

**B.** Sharp back pressure and air volume variations occur in rapping type filters when sections must be shut down for cleaning.

**A.** The **DAY** reverse air jet cleaning mechanism is gentle yet positive, cleaning each tube uniformly and permitting the use of high efficiency felt filtering cloth.

**B.** Tougher cloth with resultant poorer filtering quality must be used in rapping type filters. Cleaning effectiveness varies widely from point of vibration to where cloth is attached to filter.

**4. Parallel Air Flow**—Dust laden air enters the top plenum of the **DAY** "Autoclean" Dust Filter. Dust and air then travel together down the tubes. This parallel flow helps blow the dust into the bottom hopper. In opposed flow filters where the dust laden air enters at the bottom, the upward pressure of the air escaping through the cloth tends to hold the dust within the tube until the air is shut off.

**5. Separated Dust Streams** . . . One **DAY** "Autoclean" Dust Filter can handle several different product streams simultaneously *without mixing*. This is done by installing splitters in the receiving plenum and connecting tube rows to separate fan units as required. Individual screw lock feeders under each row of tubes discharge products separately. Thus one **DAY** Filter does the work of several individual units.

**6. Economy From The Start**—You save money on original cost with a **DAY** Filter because you buy less filter to handle equal volumes of air. Continuous-automatic operation, minimum cloth area loss for cleaning and better filtering fabric permit use of less cloth and a smaller unit to handle your filtering requirements. In addition, less floor space is needed and installation and maintenance costs are minimized.

DAY
SINCE 1881

## The DAY Company

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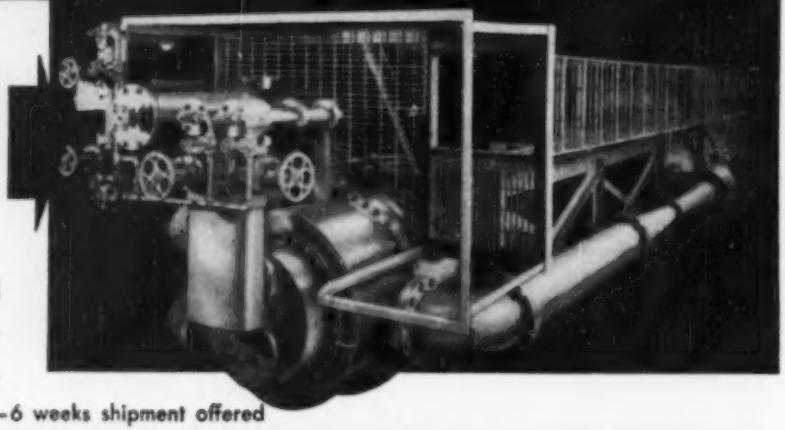

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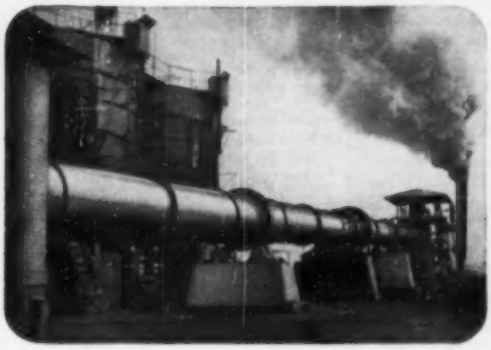
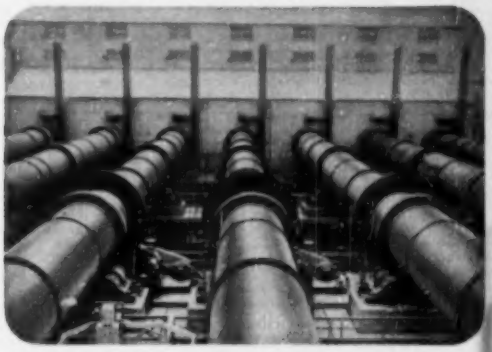
# Individual Engineering is the Hallmark of Traylor Rotary Kilns





*Contributing to* the outstanding performance of Traylor Kilns is the careful survey of each proposed installation and the subsequent designing of a kiln "tailor-made" to fit the individual requirements of the job it must do. Because this policy brings Traylor customers back again and again, many of the kilns we build today will work side by side with Traylor Kilns which are veterans. Many of these re-orders are part of expansion programs made possible by the profitable operation of Traylor Kilns.

The battery of seven Traylor Kilns is owned by a company that operates many other Traylor installations. The long list of Traylor users includes names that are by-words of industry . . . companies that attained their success while operating Traylor equipment.

## Here Are The Features That Bring Old Customers Back To Traylor

**ALL-WELDED STEEL SHELLS.** The shells of Traylor kilns are made of thick steel plates welded together to obtain single section rigidity. Reinforcing rings strengthen all circumferential joints.

**TURNED AND FACED RIDING RINGS.** Riding rings on Traylor kilns are turned and faced to a true, smooth finish. They are attached to the shells without bolts or rivets.

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**CUT STEEL GEARS AND PINIONS.** All driving gears and main pinions are precision cut from suitable steel on our Maag Gear Generator. Gears are reversible for extra service.

*The superiority* of design, construction and operation of Traylor Kilns, Coolers and Dryers is set forth fully in illustrated Bulletin 115. Write for your copy today and learn the advantages of profit making Traylor equipment.

**Traylor**

Rotary Kilns, Coolers and Dryers
Grinding Mills . Crushing Rolls
Jaw, Reduction and Gyratory Crushers

**TRAYLOR ENGINEERING & MANUFACTURING CO.**
**105 Mill St., Allentown, Pa.**

Sales Offices: New York, N. Y., Chicago, Ill., Los Angeles, Calif.
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P. Q.

**A "TRAYLOR" LEADS TO GREATER PROFITS**

# SEARCHLIGHT SECTION

## EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

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The advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page.
C. E.

*NEW ADVERTISEMENTS received by 10 A. M. January 27th will appear in the February issue subject to limitations of space available*

### POSITION AVAILABLE

(Civil) Engineering graduate with minimum 12 years' experience to supervise project engineers on building work, waste disposal and structural design. Scheduling experience also desirable. Location in East with established chemical company. Furnish detailed resume of experience and education, also salary requirements, in reply.

P-1421, Chemical Engineering
330 W. 42nd St., New York 18, N. Y.

### DESIGN ENGINEER

Responsible for mechanical design of machinery and equipment for chemical and metallurgical processes. Experienced in selection of equipment and layout. Prefer M. E. with background in chemical and metallurgical operations. Early interviews will be granted to qualified applicants furnishing full particulars regarding age, education, experience, past earnings record and salary desired.

Box CM 635, 221 W. 41st St., N. Y. 18

*REPLIES (Box. No.): Address to office nearest you*
*NEW YORK: 330 W. 42nd St. (18)*
*CHICAGO: 520 N. Michigan Ave. (11)*
*SAN FRANCISCO: 68 Post St. (4)*

### POSITIONS VACANT

CHEMICAL ENGINEER to head Dept. Large University. Salary excellent; Metallurgists. Others for Masters. Give phone, photo, qualif. Cline Teachers Agency, East Lansing, Mich.

CHEMICAL ENGINEER or Industrial chemist with plant experience for production responsibilities in heavy chemical operations. Southern location. P-1979, Chemical Engineering.

### EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (39 years recognized standing and reputation). The procedure of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 260 Dun Bldg., Buffalo 2, N. Y.

### ENGINEERS
### CHEMICAL and METALLURGICAL

Tech'l Dir.-Ph.D. ..... $10,000
petroleum research
Tech'l Dir.-Ph.D.-Paints ..... $8,500
Mineralogist-con't grad ..... Open
*Call, write or wire:* GLADYS HUNTING
DRAKE PERSONNEL
7 W. Madison St. Chicago 2, Ill.

### Engineers - Executives - Technical Men

Salaried Positions, $5,000 to $50,000. This Confidential service for men who desire a new connection, will develop and conduct preliminary negotiations without risk to present position. Send name and address for details.

TOMSETT ASSOCIATES
1206-2 Berger Bldg. Pittsburgh 19, Pa.

### EXECUTIVES
**Interested in Changing Positions**

Make use of our continuous nationwide contacts. We offer a unique, confidential & discreet service to Executives desiring to contact employers. Write for details.

**Mutual Positions Plan Association**
55 William Street New York 5, N. Y.
*(A Mutual, Non-Profit Membership Organization)*

### EMPLOYMENT SERVICES

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. B, 241 Orange St., New Haven, Conn.

### POSITIONS WANTED

MECHANICAL ENGINEER, 34. Graduate, desires position as assistant to busy executive in charge of manufacturing of group of plants or single plant, to assume full responsibility for plant rehabilitation, production and reducing operating costs. 10 years experience in chemical and food industries. PW-1469, Chemical Engineering.

CHEMICAL ENGINEER, 26 and single, graduated 1947 desires position in research or development. Background includes one year machine shop, six months foundry, 2½ years U. S. Air Forces. Since graduation, two years experience in technical press relations and as copywriter of industrial advertisements on water treatment for large midwestern manufacturer. Minimum salary $2600. PW-1754, Chemical Engineering.

MECHANICAL ENGINEER—8 years, chemical plant layout, process piping, machine design and maintenance, 7 years diversified and supervisory experience. PW-1824, Chemical Engineering.

ENGINEER EXECUTIVE, 20 yrs. operation chemical process, with layout, design, development, costs. Mid-West now must locate Phila. area even at sacrif., Sited best for wide duties in smaller firm, in plant, office or staff. Industr. and dependability can be proven. PW-1842, Chemical Engineering.

CHEMICAL ENGINEER, B.S., 1939. Interested in problems of small and medium size organizations. Experience in production supervision, design, and line and staff assignments should be valuable to organization planning expansion or modernization or needing personnel capable of immediate contributions and future growth. PW-1876, Chemical Engineering.

ENGINEER-EXECUTIVE: 17 years experience in research, pilot-plant, production and sales in chemical industries. Age 39, married, children. Can offer superior chemical specialty product for the automotive trade. PW-1912, Chemical Engineering.

### WANTED

A Major Equipment Account for the Chemical Industry by Sales Engineer Atlanta. Now Covering the Southeastern States, Contacting Other Engineers in Chemical Plants, Power Plants, Textile and Rayon Mills and Consulting Engineers. Desire to Represent a Manufacturer of Major Equipment, the Sale of Which Is Dependent Upon Acceptance by the Above Group, Before the Sale Can Be Made.

BA-1870, Chemical Engineering
330 W. 42nd St., New York 18, N. Y.

### Saint Louis Manufacturer's Agent

now contacting manufacturers, engineers and processors in this territory seeking major account of reliable and progressive manufacturer. Can give personal, prompt and efficient handling your business.

BA-1807, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

### NEED REPRESENTATIVE FOR LA, SOUTH MISS. AND MOBILE?

Chemical Eng. handling successfully several outstanding instrument lines desires well-known pump, water-softener, blower or other suitable heavy equipment as addition, which can be sold competitively.

BA-1762, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

### DESIRABLE FACTORY SPACE

CENTRAL WISCONSIN COMMUNITY desires to acquire new industries and will erect for qualified industry 15,000 to 30,000 square feet of factory space to suit purpose. For further information write

ROWINSKI ENGINEERING
INDUSTRIAL ENGINEERS
RHINELANDER, WISCONSIN

### WANTED • CHEMICAL PLANT

*Large financially powerful diversified organization wishes to add another enterprise to present holdings*

### CASH PAID

*For Capital Stock or Assets Existing Personnel Normally Retained*

Box (22)
1474 B'way, N. Y. 18, N. Y.

### WANTED

*ALL TYPES OF*

**By-products**
**Wastes**
**Residues**
**Contaminated Solvents**

Recovery Facilities Available
Drum Lots—Tank Cars

### TRULAND

CHEMICAL & ENGINEERING CO., INC.
P. O. Box 426, Union, N. J. Unionville 2-7280

### WANTED—SOLVENT

Wastes of All Kinds
REDISTILL OR PURCHASE
Also Surplus Chemicals, Dyes, Pigments, Oils, etc., By-Products, Residues, Equipment

CHEMICAL SERVICE CORP.
80-04 Beaver St. New York 5, N. Y.

### Compressors Wanted

STATIONARY - PORTABLE
LARGE OR SMALL

L. W. BAUER
22 Barnett Street Bloomfield, N. J.

# GOOD NEWS FOR 1950

Anyone can sell you ordinary used Equipment. But, when "Consolidated" sells you—you buy the BEST in used and rebuilt machinery, with the "Consolidated" GUARANTEE. You buy with Confidence.

A few selected items from stock

1—6' x 4' Oliver all Stainless Steel Top Feed Rotary Continuous Vacuum Filter. UNUSED. Never installed. Intended to filter ammonium sulphate.

2—#12 Sweetland Pressure Filters drilled on 2" and 4" centers.

5—Foote Bros. Type 8HGV Corm Reducers, Ratio 6.33-1, with or without 10 HP 3/60/220-440V. 1750 RPM Motors.

1—8' x 125' Reeves Rotary Kiln.

1—2' x 15' Rotary Kiln, experimental, complete.

2—6' x 12' Allis Chalmers Rod Mills.

1—#4 TH Mikro Pulverizer Rebuilt—available for immediate shipment.

2—200 Gal. Patterson Pebble Mills, 4'x5', Burrstone lined with drives and motor.

1—#1 Banbury Mixer, chrome plated rotors, with drive and 40 HP Motor.

1—Louisville Rotary Steam Tube Dryer 6'x50'.

1—Rotary Vacuum Dryer 5' x 33'.

1—Vacuum Shelf Dryer, 17 Shelves, 40' x 43".

3—7500 gal. Closed Steel Kettles, 10' dia. x 12'6" deep, with Copper Coils, Closed. Bronze Propeller Agitators, Enclosed Motor Driven Worm Gear Drives.

5—Modern Engineering Co. RVD8 Enclosed Worm Reducers, Ratio 6.43-1, with or without 10 HP 3/60/220-440V 1750 RPM Motors.

3—Baker Perkins Mixers, Size 17, Jacketed, 200 gal., also 100 gallon.

1—Buffalo all lead Single Effect Evaporator, 200 sq. ft., with all accessories.

1—600 sq. ft. all copper Single Effect Evaporator or Calandria Pan with Barometric Condenser, Jet Ejector and all accessories.
1—42" x 42" Shriver, cast iron, plate & frame Filter Press, side feed, open delivery, 41 chambers, self-contained hydraulic closing device.
1—4' x 6' Buffalo Chilling Roll or Flaker, direct Vari-Speed Reduction Gear Motor Drive.
1—30" Shriver Filter Press, cast iron, steam jacketed, plate and frame, closed delivery, gear closing, makes 20—1" cakes.
1—Aluminum, Horizontal Jacketed, ribbon type Mixer, 1,000 gallons capacity.

**ONLY A PARTIAL LIST—SEND US YOUR INQUIRIES**

**WANTED—YOUR IDLE MACHINERY**
We buy and sell from single items to Complete Plants

**LIQUIDATING** 3 Dairy Plants in Missouri

Motor driven Refrigerating Units, Double Drum Atmospheric Dryers, Stainless Steel Vacuum Pans, Condensers, Tanks, Pasteurizers, Pumps, etc.

*Send for complete illustrated circular*

THE KEY TO SAVING TIME AND MONEY

**CONSOLIDATED PRODUCTS COMPANY, INC.**

15 Park Row, New York 7, N. Y.—Tel. BArclay 7-0600
Shops: 335 Doremus Ave., Newark, N. J. Cable Address: Equipment, N. Y.

# "BUY BRILL—BUY THE BEST"

### FILTERS

3—Sweetland #12 with 36-10" dia. leaves.
2—Sweetland #10 with 54-10" dia. leaves.
1—Sweetland #7 with 20-25" dia. leaves.
3—Sweetland #2 all stainless with 12 B. S. leaves.
3—Oliver Rotary Vac. 11'0" x 15'.
2—Oliver Rotary Vac. 8' x 12', 8' x 8'.
1—Oliver Top Feed Rotary Vac. 6' x 5', monel clad.
2—Lima Rotary Vac. 4' x 6', 1½' x 1', of stainless steel construction.
2—Shriver 12" x 12" P&F, 12 chambers, C. I.
1—Sperry Type 24" x 24" P&F, 28 chambers, C. I.
1—Shriver 24" x 24" recessed, 36 chambers, C. I.
1—Sperry 30" x 30" recessed, 30 chambers, C. I.
3—Sperry 32" x 32", 36" x 36" P&F, 30 chambers, C. I.
2—Kelly 40" x 40" P&F, 45 chambers, C. I.
12—Shriver, Sperry Skeletons, 18" to 42".

### SCREENS

3—Rotex #82 Double Deck 40"x120", all stainless.
5—Day #81 Single Deck 40"x120", 40"x84".
6—Tyler Hummer 4'x10', 4'x5', 3'x10', 3'x10', 3'x5, with Thermionic units.

### CENTRIFUGALS

2—AT&M 48" x 40" Suspended, S. S. imperforate baskets, bottom discharge.
1—Bird 48" Suspended, solid steel basket.
1—Tolhurst 40" center slung S. S. perforated basket.
1—Fletcher 40" center slung steel basket.
1—AT&M 30" Suspended, hercnite perforated basket.
2—AT&M 20" rubber-covered basket.
1—Bird Continuous 18" x 20" solid monel bowl.
1—Sharples #16, Stainless Steel, 2 HP motor.
4—Sharples #6, Steel, 2 HP motor.

### DRYERS—KILNS

10—Ross Eng. 2 Truck Atmospheric Dryers, steam heated, 500 sq. ft.
2—Proctor & Schwartz 19 and 0 section Ringle Conveyor.
6—Buffovak 32" x 196", 46" x 72", 32" x 72", Atmospheric Single Drum.
6—Allis Chalmers Kilns 9'6" x 250', 9' x 80', 7'6" x 125'.
1—Bartlett & Snow 6' x 42' Kiln.

### WANTED
YOUR SURPLUS MACHINERY

WE PURCHASE SINGLE ITEMS TO COMPLETE PLANTS

1—Bartlett & Snow 4' x 45'0" jacketed Rotary Cooler.
4—Ruggles-Coles Special Class XC-10 Steam Tube Dryers, 70'0" x 60" long.
1—Devine 3' x 16' S. S. clad Rotary Dryer.
1—Devine #23 Vac. Shelf, 12—60" x 78" shelves.
3—Stokes, Devine Rotary Vac. 1½' x 3', 3' x 15', 3' x 30'.
1—Spray Dryer, Stainless Steel, 6' chambers.
1—Devine Vac. Shelf Dryer, 15—60" x 78" shelves.

### PULVERIZERS—MILLS

1—Williams Titan 5-roll High Side Mill with 8' super separator, 6' cyclone, 8' collector, ducts, etc.
1—Patterson 6' x 8' jacketed Pebble Mill.
2—Patterson 5' x 6', 3' x 4' jacketed Ball Mills.
1—Patterson 4' x 5' silex-lined Pebble Mill.
4—Rodgers 3' x 4', 2' x 3' Pebble Mills.
2—Abbe, Eureka #3 Jar Mills.
4—Mikro Pulverizers #4TH, #2TH, #1SH.
3—JaBray 36" x 60", 30" x 24" Hammer Mills.
1—Jay Bee Type UX Hammer Mill.
4—Bauer Attrition Mills 24" and 36".
1—Williams 16" x 20" Standard Hammer Mill.
2—Simpson Intensive Mixers #0.
3—Ball & Jewell #1, #2 and #2½ Rotary Cutters.
2—Raymond 4-10 and 7-50 Imp Mills.

Partial List Only—Catalogs, Quotations furnished on request.

### KETTLES—EVAPORATORS

1—Pfaudler 500 gal. glass-lined, jacketed, agitated Reactor.
5—Stainless Steel 7'0" x 8'0" jacketed, agitated Reactors, 2000 gal. each.
3—Dopp jktd., agitated Kettles 600, 250, 150 gal.
1—Steel 250 gal. jacketed, agitated Kettle.
6—Glass-lined Storage Tanks 20 to 500 gal.
8—Stainless Steel Storage Tanks 4-6-, 10,000 gal.
3—Pfaudler 200 gal. glass-lined Tanks.
10—Steel Horizontal Tanks, 10,000 to 20,000 gal.
1—Swenson 20' sections Continuous Crystallizers.
6—Copper Vacuum Stills or Pans, 75 to 500 gal.
1—Steel Rectifying Column 12" dia.
1—Copper Rectifying Column & Beer Still, 30" dia.
3—Stainless Steel Rectifying Columns, 6" dia.
5—Evaporators, Triple and Quadruple Effects, 3000, 5000 and 10,000 sq. ft.

### MIXERS—ALL TYPES

2—Baker Perkins 100, 4½-gal. jacketed Double Arm Vacuum.
4—Baker Perkins 150, 100, 50-gal. jacketed Double Arm.
2—Baker Perkins Stainless Steel Double Arm, 1 & 2 gal.
1—Day #6 Cincinnatus, jacketed, Double Arm, 100 gal.
10—Day, Robinson 100 Lb. to 2000 Lb. Powder Mixers.
1—Wolf 4000 lb. Steel Powder Mixer.
1—Robinson 1000 lb. jacketed Powder Mixer.
6—Rodgers 400 lb. to 2000 lb. steel and stainless steel Powder Mixers.
25—Electric Portable Agitators ¼ HP to 5 HP.

### MISCELLANEOUS

2—Buffovak 6' dia. Crystallizers.
2—Knapp, Automatic Can Labelers to #10 cans.
3—Stokes & Smith super type Powder Fillers.
2—Colton #4 worm style Tube and Jar Fillers.
1—Knapp #429 Carton Sealer w. compression unit.
1—Rodgers auger type Powder and Paste Filler.
2—Hoehn Aiken, Jones, Automatic Soap Presses.
1—Anderson #1 Expeller, 15 HP.
3—Nash Hytor Vacuum Pumps to 300 cfm.
2—Hoechin, Lehman 12" and 9" Soap Plodders.
1—Dilatte acid-proof centrifugal Pumps, 2" x 1½", 5 HP.
2—2500-lb. Soap Crutchers.

# BRILL EQUIPMENT COMPANY

2401 Third Ave.,
New York 51, N. Y.
*Tel. Cypress 2-5703*

## GET QUALITY WITH AMERICAN — THE BEST IN REBUILT COMPRESSORS — SAVE 40% TO 60%

### STATIONARY

| CFM | Max. Pres. | Size | Make |
|---|---|---|---|
| 20 | 100 | 4x4 | INGERSOLL ER1 |
| 44 | 110 | 5x4 | INGERSOLL ER1 |
| 44 | 150 | 5x3 | INGERSOLL ER1 |
| 60 | 110 | 6x3 | AM-IR-PA-WORTH |
| 60 | 110 | 6x3 | IR-CPT |
| 69 | 250 | 6 ½x8 | INGERSOLL ER2 |
| 86 | 60 | 7x8 | INGERSOLL ER1 |
| 93 | 100 | 7x7 | AM-CPT-IR |
| 100 | 100 | 7½x8 | CHICAGO Mod |
| 120 | 70 | 8x8 | IR-PA |
| 122 | 100 | 7x7 | WORTHINGTON HB |
| 129 | 100 | 7½x7 | AMERICAN AFI |
| 138 | 125 | 8x8 | CPT-IR |
| 153 | 80 | 9x8 | PA-IR |
| 161 | 60 | 8x7 | WORTH HB |
| 173 | 100 | 9x8 | IR-CPT-SULLIVAN |
| 233 | 70 | 10x8 | IR-PA |
| 234 | 125 | 10x10 | IR-CPT |
| 273 | 10 | 12x8 | IR |
| 316 | 35 | 11x10 | WORTHINGTON |
| 330 | 40 | 12x8 | IR-CPT |
| 350 | 125 | 11x12 | WORTHINGTON |
| 368 | 100 | 12x10 | IR-CPT-PA |
| 368 | 150 | 12-7½x10 | PENN |
| 386 | 125 | 12x12 | CPT-IR |
| 448 | 100 | 11¾-7x7 | CHICAGO Y-CM |
| 528 | 100 | 14x12 | IR-CPT-GD |
| 577 | 50 | 13x10 | PENN |
| 605 | 150 | 16x10 | PENN |
| 676 | 125 | 15 ¾x12 | INGERSOLL XCB-2 |
| 877 | 125 | 17 10¾x14 | INGERSOLL XCB-2 |

HOW ABOUT A STANDBY UNIT? CHEAP INSURANCE!

### PORTABLE

17 CFM—Lindsay
36 CFM—Schramm
69 CFM—CPT IR—Worthington
105 CFM—Worth—IR—Sullivan
160 CFM—Worthington (Diesel) 4 Pneu
210 CFM—Gardner Denver (Gas) 4 Pneu
210 CFM—Worthington (Gas & Diesel)
315 CFM—Worthington (Gas) 4 Pneu
315 CFM—Le Roi (Gas) 4 Pneu
315 CFM—Chicago (Diesel) 4 Pneu
315 CFM—Ingersoll (Diesel) 4 Pneu
500 CFM—Worth—Chicago

### VACUUM PUMPS (DRY)

67 CFM—Worth—Two stage
134 CFM—Worth—Single stage
250 CFM—Worth (Vertical) 18 x 6
334 CFM—IR-Penn—14 x 5
1080 CFM—Ingersoll Rand ERI 22 x 8
2925 CFM—Ingersoll 32 x 14

### SPECIALS

| CFM | Pressure | Make | Model |
|---|---|---|---|
| 20.5 | 250 | Worth | BW500 |
| 60 | 800 | IR | Type 20 |
| 61 | 1000 | Worth | CS |
| 105 | 350 | CPT | T-CB |
| 119 | 3000 | IR | Type 40 |
| 160 | | Gardner Denver & Sullivan | WB and WL-60 |
| 179 | | | |
| 230 | 125 | | |
| 289 | | | |
| 306 | 125 | Worth | M-75 |
| 1055 | 110 | IR | XRE |
| 1290 | 125 | Worth | VD |
| 1452 | 70 | Penn | DBI |
| 2360 | 125 | CPT | W-CR |

SALE—RENT—RENTAL PURCHASE

**AMERICAN AIR COMPRESSOR CORP.**

NORTH BERGEN
NEW JERSEY

TELEPHONE— N. J. UNION 5-4848
N. Y. Chickering 4-7665

**Immediate Shipment From Stock**

*Squirrel Cage Motors*

| H. P. | Mfr. | Type | Speed |
|---|---|---|---|
| 150 | Reliance | TEFC | 1200 |
| 125 | Reliance | TEFC | 1800 |
| 100 | Reliance | TEFC | 3600 |
| 100 | Cont. | Expl. Pf. | 1200 |
| 100 | Reliance | TEFC | 1200 |
| 100 | Reliance | TEFC | 900 |
| 75 | Reliance | TEFC | 1800 |
| 75 | Reliance | TEFC | 1200 |
| 75 | Reliance | TEFC | 900 |
| 60 | G. E. | TEFC | 1800 |
| 60 | Reliance | TEFC | 1200 |
| 50 | Reliance | TEFC | 1200 |
| 40 | Reliance | TEFC | 1800 |
| 40 | Al. Ch. | TEFC | 900 |
| 30 | G. E. | TEFC | 1800 |
| 25 | Louis Allis | TEFC | 1800 |

*Expl. Proof & TEFC all sizes under 25 H.P.*

- GEARHEAD MOTORS, NEW & REBUILT.
- SPEED REDUCERS, V-DRIVES.
- FANS, BLOWERS, PUMPS.
- 25 CYCLE & D. C. MOTORS.

High Quality & Full Guarantee - - Since 1900

**ARTHUR WAGNER CO.**
1437 W. Randolph St. Chicago 7
ELECTRIC MOTORS - GENERATORS

### OIL & ACID TANKS

6—25,000 gal. Horiz. 10'6" x 38'0" Shell ⅜"
1—16'9" x 20', 2—16'9" x 19'9", 1—8'9" x 34" all ⅜ in. Shells Butt Welded Horiz.
2—10,000 Bbl New Vert. Tanks
6—12,000 & 15,000 & 20,000 gal. Cap. Horiz.
30—New 10,000 gal. Horiz. 60 lb. Test
LESTAN CORP., ROSEMONT, PA.

### WATER SOFTENER

Cochrane Hot Lime-soda process unit complete. Design 135. Capacity, 6000 G.P.H. Used only one year. *Priced for quick sale.*

The STANDARD LIME and STONE CO.
Baltimore 3, Maryland

# WHERE DREAMS COME TRUE---

# GELB MACHINERY

THE GELB GIRL—JANUARY 1950

1—Sperry 24" Stainless Steel Filter Press, closed delivery, 12 chambers with hydraulic closing.
1—Sperry S.S. Filter Press, 12" x 12", 15 chambers.
1—Shriver 42" x 42" Filter Press, 46 chambers with hydraulic closing.
1—Sperry Plate & Frame Al. Filter Press, 18" x 18".
1—Shriver Bronze plate and frame Filter Press, 18" x 18".
1—Sperry Rubber-lined Filter Press, 12" x 12", recessed type, closed delivery.
1—Sperry 24" x 24" Filter Press, closed delivery, 12 chambers.
3—Shriver Plate and Frame Lab. Filter Presses, 7" x 7".

1—Shriver 30" x 30" closed delivery filter press. 28 chambers.
1—Shriver 36" x 36" closed delivery filter press. 48 chambers.
1—Shriver 36" x 36" Filter Press, closed delivery.
1—Vallez #3 Filter.
1—Shriver 42" Skeleton.
1—Sperry 36" x 36" Recessed Type Filter, center feed, open delivery, 42 Heresite covered plates.
2—Black & Clawson Double Drum Dryers, 28" x 5'.
1—Bartlett & Snow direct fired Kiln, 8½' x 50'.
1—Ruggles Cole direct fired Kiln, 7' x 60'.
1—Buffalo Double Drum Dryer, 36" x 72", chrome plated drums.
1—Banbury Mixer #1 with 50 HP motor.
4—Baker Perkins Jacketed Vacuum Type Double Arm Mixers, w/motors and drives, 600# capacity.
3—Cavagnarro Vacuum type Double-arm Mixers w/motors and drives, 600# capacity, Stainless Steel.
1—J. H. Day double arm, jacketed Mixer, sigma blades, 500 gallons.
3—J. H.Day double arm, jacketed Mixers, 50 gals., sigma blades.
1—Baker Perkins double arm jacketed Mixer, 200 gals., sigma blades.
5—Baker Perkins double arm Mixers, 200 gals., sigma blades.
1—J. H. Day Lab. Type Mixer.
1—Patterson nickel lined Blender, 192 cu. ft. cap., w/20 HP Motor.
2—J. H. Day Mogul type Mixers, 2½ gallons & 5 gallons.
1—J. H. Day type M B D Stainless Steel Kneader, 12 gallons.
5—Simpson #0 Intensive Mixers (New)
1—Bird Suspended type Centrifuge. 40" Stainless Steel perforated basket, with motor.
1—Tolhurst Suspended type Centrifuge, 40" rubber perforated basket, with motor.
1—Podbielniak Stainless Steel Centrifugal Extractor, Model 6080.
10—Sharples Super Pressure Centrifuge, with 3 HP Expl. proof motors.
1—Sharples Super Pressurite Centrifuge, SS Bowl, Model 18V
1—A T & M Suspended type Centrifuge, 30", Stainless steel perforated basket, with motor.
1—Tolhurst Suspended type Centrifuge, 26", Stainless steel perforated basket, with motor.

2—Buflovak Vacuum Drum Dryers, 24" x 20".
2—Buflovak Vacuum Drum Dryers, 5'10" x 10'.
2—Louisville Rotary Steam Tube Dryers, 6' x 50'.
1—Louisville Rotary Steam Tube Dryer, 54" x 30'.
2—Buffalo Double Door Vacuum Shelf Dryers, 12 & 14 shelves.
3—Buffalo Flakers, 5' x 12'.

1—Royle #1 Perfected Extruder, with heating unit.
1—Allis Chalmers Ball Mill, 5'8" x 18', Silex lined.
3—Hardinge Conical Ball Mills, 8' x 30", 5' x 22", 6' x 22".
1—Royle #½ Perfected Extruder, with heating unit.
1—Kettle 300 gallons, with Mixer (ASME).
1—Plate Fabricator, jacketed Kettle, 900 gallons, 125 PSI (ASME).
1—Steel Jacketed Kettle, 7'3" x 7'.
1—Cast Iron Jacketed Kettle, 300 gallons.
1—Pfaudler glass lined jacketed kettle A S M E code 6' dia.—9' long.
2—Pfaudler 500 gallon glass lined storage tanks (Horizontal).
1—Buffalo Cast Iron Jacketed Kettle, 600 gallons, with mixer.
1—Blaw-Knox jacketed Autoclave, 3' x 4'2", with agitator.
1—Patterson Jacketed Autoclave, 3' x 3'9".
2—Alloy Fabricators, S. S. jacketed Reaction Kettles, 170 gallons with agitator and motor.
1—Stainless Steel Direct Fired Still ,6" x 6", with coils and agitator.
1—Steel Storage Tank, 10,000 gallons, 1" plate.
2—Steel Pressure Tanks, 4' x 11', 200 PSI.
1—Patterson 5,000 gallon mixing Kettle (New).
1—Glasscote 1,000 gallon glass lined Jacketed Reactor (New).
2—Pfaudler Aluminum Jacketed Reactors, 1300 gallons & 250 gallons (New).
3—Stainless Steel Jacketed Kettles, 30" x 3'.
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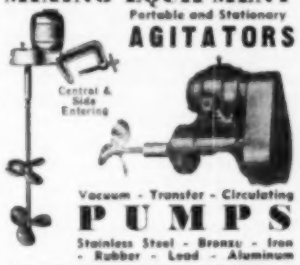


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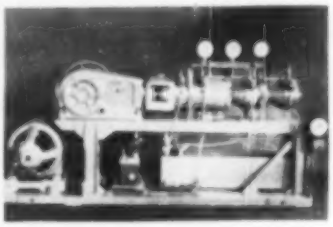

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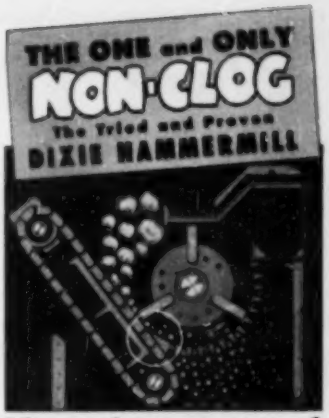


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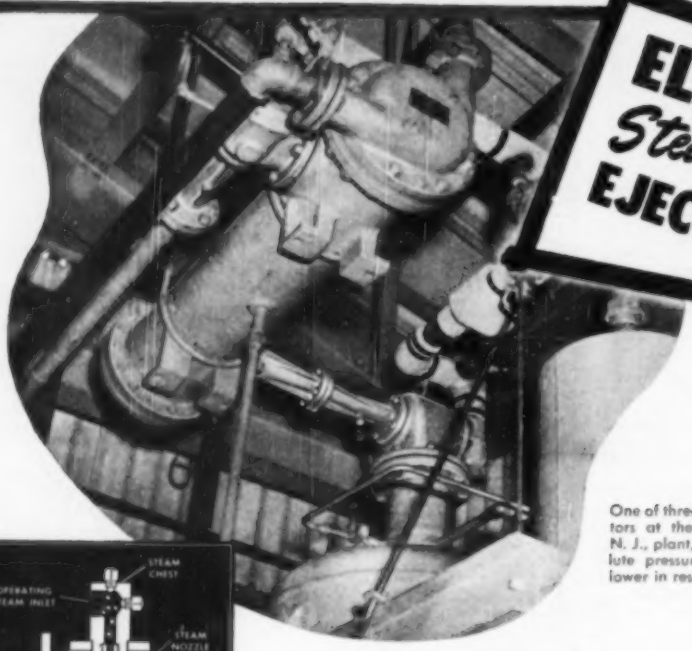
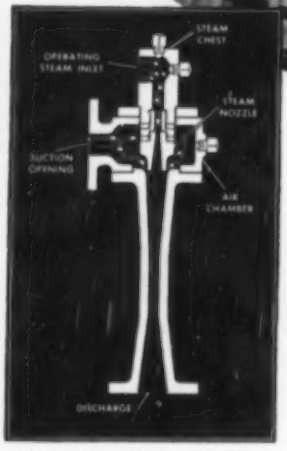



One of three Elliott two-stage ejectors at the Hercules Burlington, N. J., plant, which maintain absolute pressures of 1 in. Hg and lower in resin kettles.

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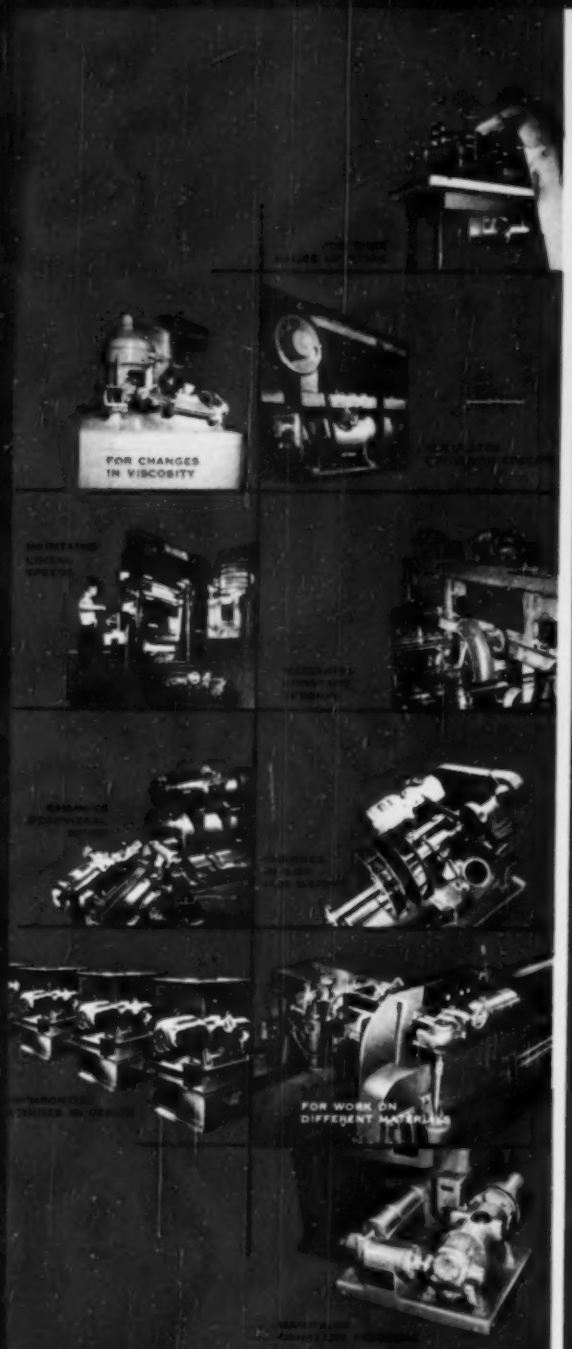


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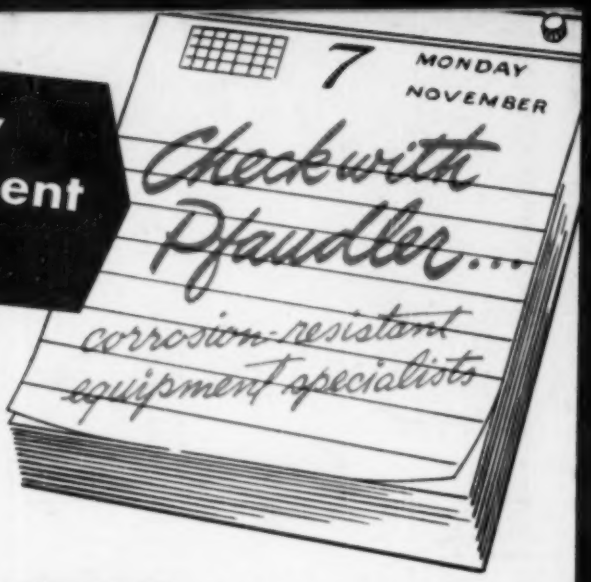

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